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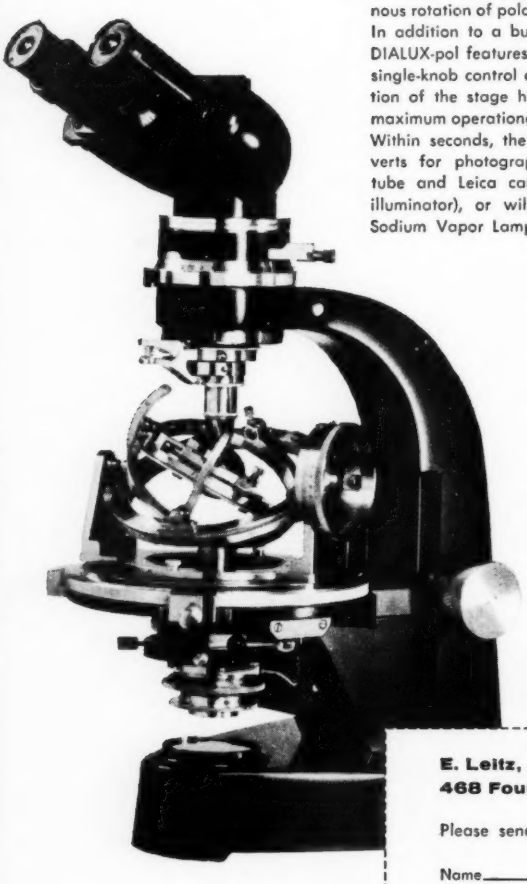

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Calendar

Cooperation of Society Secretaries in supplying meeting notices for GEOTIMES calendar is requested.

*May 11-13, 1961—GSA: Rocky Mountain Sect., meeting at Laramie, Wyo., with 1-day field trip to study Precambrian and sedimentary rocks and geomorphology in the Laramie Basin. Write: W. R. Keefer, Box 3007, Univ. Sta., Laramie.

*May 12-14, 1961—AIME: Central New Mexico Sect., Sixth Ann. Uranium Symposium, Grants, N.M. Field trip to neighboring mines and mills.

May 15-16, 1961—SYMPOSIUM ON OCEANOGRAPHY, Univ. of Wisconsin, to (1) take stock of present marine research and (2) to stimulate interest and midwest participation in Oceanography. Write: R. A. Ragotzkie, Dept. of Meteorology, Univ. of Wisconsin, Madison 6, Wis.

May 17-19, 1961—SOC. OF PROFESSIONAL WELL LOG ANALYSTS, 2nd Ann. Meeting and Logging Symposium, Sheraton-Dallas Hotel, Dallas.

May 25-26—AIME: Joint Meeting Rocky Mountain Petroleum Sects., Salt Lake City, Utah.

May 29-June 3, 1961—INTERNAT. COLLOQUIUM ON THE EVOLUTION OF VERTEBRATES, Paris, France. Write: Prof. Jean-Pierre Lehmann, Mus. Nat. d'Histoire Naturelle, 57, rue Cuvier, Paris 5e, France.

June 15, 1961—INST. OF MINING & METALULRGY, Ann. Gen. Meeting, London. 44 Portland Pl., London, W.1, England.

June 26-29, 1961—CANADIAN SOIL SCIENCE SOC., Ann. Meeting, Regina, Sask., Canada.

June-July, 1961—WORLD METEOROLOGICAL ORGANIZATION, Regional Assoc. III (South America), Session, 3rd, Rio de Janeiro, Brazil. Campagne Rigot, Av. de la Paix, Geneva, Switzerland.

July 3-6, 1961—INTERNAT. COLLOQUIUM ON THE GENESIS AND SYNTHESIS OF CLAY MINERALS, Paris, France. Write: Prof. Hocart, Faculte des Sciences, Université de Paris a la Sorbonne, 47 rue des Ecoles, Paris 5e.

July 17-22—INTERNAT. CONF. ON SOIL MECHANICS & FOUNDATION ENGINEERING, 5th, Paris, France. M. Buisson, Gen. Sec'y., Assoc. Francaise de Mech. des Sols et des Fondations, 31, rue Henri Rochefort, Paris 17e, France.

July 30-Aug. 4, 1961—AMER. CRYSTALLOGRAPHIC ASSOC., Boulder, Colo.

Aug. 21-31, 1961—U.N. CONF. ON NEW SOURCES OF ENERGY, (Solar Energy, Wind Power and Geothermic Energy), Rome. Write: U.N., New York.

Aug. 21-Sept. 6—PACIFIC SCIENCE CONGRESS, 10th, Honolulu, Hawaii. Pacific Science Assoc. Secretary General, 10th Pacif. Sci. Cong., Bishop Museum, Honolulu 7, Hawaii.

Aug. 21-Sept. 6—SPECIAL COMMITTEE ON OCEANIC RESEARCH, 5th Meeting, Honolulu. Dr. Günther Böhnecke, Secy., Bernhard-Nochstr. 78, Hamburg 4, Germany.

Aug. 27-Sept. 21, 1961—INTERNAT. ASSOC. ON QUATERNARY RESEARCH, 6th Internat. Congress, Warsaw, Poland.

Summer—INTERNAT. COUNCIL OF SCIENTIFIC UNIONS, 9th General Assembly, London, Eng. National Academy of Sciences-National Research Council, Washington 25, D. C.

September, 1961—INTERNAT. PALEONTOLOGICAL UNION/MEDITERRANEAN NEOCENE COMMITTEE, Meeting, Sabadell, Spain. Write: J. Roger, Serv. d'Information Geol. du B.R.G.M., 74, rue de la Federation Paris 15.

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Sept. 3-8, 1961—AMER. CHEM. SOC., 140th meeting, Chicago, Ill.

Sept. 18-23—III INTERNAT. CONGRESS OF SPELEOLOGY, Vienna, with excursions before and after the meetings. Write: Generalsekretariat des 3. Internationalen Kongresses für Speläologie, Verband österreichischer Hohlenforscher, Wien II, Obere Donaustrasse 99/7/3.

Oct. (9-10 days) 1961—SYMPOSIUM ON THE FORMATION OF IGNIMBRITES, HYALOCLASTITES AND RELATED DEPOSITS, Catania, Sicily. Write: Prof. A. Rittmann, Pres., Internat. Assoc. of Volcanology, c/o Dept. of Volcanology, Catania Univ., Catania, Sicily.

Oct. 8-11, 1961—AIME: Soc. of Petr. Engrs., Fall meeting, Dallas, Texas.

*Oct. 14-18, 1961—NATIONAL CLAY CONF., Univ. of Texas, Austin. Field trip Oct. 14 to bentonite localities of Texas Gulf Coast and vermiculite field trip Oct. 15. Write: E. Joseph Weiss re program or papers and Stephen E. Clabaugh re field trips, both at Univ. of Texas.

Oct. 18-20, 1961—OPTICAL SOC. OF AMER., Ann. Meeting, Los Angeles, Calif.

Oct. 18-21, 1961—AAPG: Mid-Cont. Regional meeting, Amarillo, Texas.

Oct. 25-27, 1961—GULF COAST ASSOC. OF GEOL. SOC'S., meeting, San Antonio, Tex.

Oct. 30-Nov. 1, 1961—SVP: Ann. Meeting, Chicago Nat. Hist. Mus., Chicago.

Oct. or Nov. 1961—INTERNAT. MINING CONVENTION, El Paso, Texas. Write: M. Hopper, 310 San Francisco St., El Paso.

*Nov. 1-3, 1961—SOUTHWESTERN FED. OF GEOL. SOC'S., Ann. Meeting. El Paso, Tex. Trip into northern Chihuahua, Mex. to study geol. of the area. Write: Texas Western Coll., Geol. Dept., El Paso.

Nov. 2-3, 1961—AIME: Soc. of Petr. Engrs., 32nd Ann. California regional meeting, Los Angeles, Calif.

*Nov. 2-4. 1961—GSA: Ann. Meeting, Cincinnati, Ohio. Nine trips through area around Cincinnati to study Paleozoic stratig. and struct.; Write: Ralph J. Bernhagen, Ohio Geol. Surv., Ohio State Univ., Columbus 10. re trips. Guidebooks.

Nov. 5-9. 1961—SEGp: 31st Ann. Internat. Meeting, Hilton Hotel, Denver, Colo.

Nov. 13-15, 1961—A.P.I.: Ann. Meeting, Chicago.

Nov. 15-17, 1961—EASTERN ANALYTICAL SYMPOSIUM, Hotel Statler Hilton, New York City.

Dec. 26-31, 1961—AAAS: Ann. Meeting, Denver, Colorado.

*Dec. 7-9, 1961—NAGT, Texas Sect., & Texas Acad. of Sci., Joint Ann. Meetings, and half day trip through Gulf Coastal area on Dec. 9. Write: J. W. Dixon, Dept. Geol., Baylor Univ., Waco, Texas.

1961 SCHEDULE OF FIELD TRIPS

For additional field trips held in conjunction with meetings, see those items marked with an asterisk under meeting calendar.

May 12-13—SEPM-SAN JOAQUIN GEOL. SOC., trip to San Joaquin Valley in so. part of Kern Co. to study Tertiary rocks of so. part of Valley. Write: Richard Pierce, Box 147, Bakersfield, Calif. Guidebook.

May 13—SEPM-GULF COAST SECT., trip to Houston, Cherokee and Nacogdoches Co's. to study type localities of Cook Mtn., Crockett, Weches and Reklaw Eocene fms. Write: Richard P. Zinguia, Box 2180, Houston 1. Guidebook.

May 20—ILLINOIS STATE GEOL. SURV., trip to Mazon Creek and Braidwood plant fossil collecting areas, quarries and outcrops of Morris area, Grundy County, Ill.

May 20-21—EASTERN FRIENDS OF PLEISTOCENE, trip to SW Maine to study Late Pleistocene and marine stratigraphy. Write: Arthur L. Bloom, Cornell Univ., Ithaca, N.Y.

May 27, 1961—PHILADELPHIA GEOL. SOC., field trip to coastal plain of N. J. Write: Horace G. Richards, Acad. Nat. Sci., 19th and the Parkway, Phila. 3, Pa.

May 27-28—GEOL. SOC. OF SACRAMENTO, trip to Sacramento Valley on E. side to study Marysville Butte and Feather R. Canyon, etc. Write: Lowell Garrison, Box 4195, Sacramento 21. Guidebook.

May ??—MIDWESTERN FRIENDS OF PLEISTOCENE, no data available except that trip is to be conducted. Write C. P. Gravener, Geol. Div., Research Council of Alberta, Edmonton.

June 8-10—BILLINGS GEOL. SOC., a float trip in inflatable rafts down Big Horn Canyon prior to flooding by Yellowtail Dam to study Cretaceous to Cambrian in Canyon. Write: L. T. Hart, Box 318, Billings, Mont.

Aug. 2-5—WYOMING GEOL. ASSOC., 16th Ann. Field Conf. Trip to portions of Green River Basin, Rawlins Uplift, Wind River Basin and W. flank of Powder River Basin to study post-Cody and pre-Eocene stratig. Write: WGA, P.O. Box 545, Casper, Wyo.

Aug. 25-26 — FRIENDS OF THE PLEISTOCENE, Rocky Mountain Section, 7th Ann. Field Conf., Bear Lake-American Falls, Ida. Write for inf. and reservations: J. Stewart Williams, Utah State U., Logan.

Sept. 7-8—ROCKY MOUNTAIN ASSOC. OF GEOLOGISTS, field conf. to study pre-Pennsylvanian section in Salida, Monarch, Ouray, Silverton and Durango areas. Technical session in Salida night of Sept. 6. Write: Conf. chairman D. W. Bergman, 315 Colorado Bldg., Denver, Colo. Guidebook.

Sept. 7-9—ALBERTA SOC. PETROL. GEOL., trip to Turner Valley, Savannah Creek and Kananaskis Lakes, southwest Calgary foothills and mountains to study mountain structures and Paleozoic and Mesozoic stratig. Write: H. G. Gammell, 528 9th Ave., W., Calgary, Alta. Guidebook.

Oct. 5-8—NEW MEXICO GEOL. SOC., trip to Sandia Mtns., Hagan Basin, Jemez Mtns. in SE San Juan Basin and Lucero Uplift to study geology of Albuquerque area. Write: Charles Reed, USGS, Box 4083, Albuquerque. Guidebook.

Oct. 7—UTAH GEOL. SOC., trip to Bingham mining district and adjacent Oquirrh Mtns. to study stratig. and struct. of district and mountains. Write: Douglas R. Cook, 1935 S. Main St., Salt Lake City. Guidebook.

Oct. 18-21—WEST TEXAS GEOL. SOC., trip to Coke, Nolan, Fisher and Stonewall Co's. Texas to study Permian stratig. and oil fields of the area. Write: Martin L. Johnson, Box 1540, Midland, Texas. Guidebook.

October—TRI-STATE GEOL. FIELD CONF., a trip will be conducted, but no details available. Write: Stanley Harris, Dept. Geol., Southern Illinois Univ., Carbondale, Ill.

October—ASSOC. OF MISSOURI GEOL., trip to St. Francois Mtns. of Ozark Uplift to study Precambrian and engineering geology. Write: W. C. Hayes, Mo. Geol. Surv., Box 250, Rolla, Mo. Guidebook.

FIELD TRIP CALENDAR

Most of the information regarding field trips in this calendar appears through the courtesy and cooperation of the AAPG Field Trip Committee. Corrections, additions and new trip notices should be sent to George H. Fentress, Chairman, AAPG Field Trip Committee, P. O. Box 2585, Denver 1, Colo., with a carbon copy to GeoTimes Calendar, American Geological Institute, 2101 Constitution Ave., N.W., Washington 25, D. C.

This Month in GEOTIMES

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Robert C. Stephenson, EDITOR

Kathryn Lohman, CIRCULATION MANAGER

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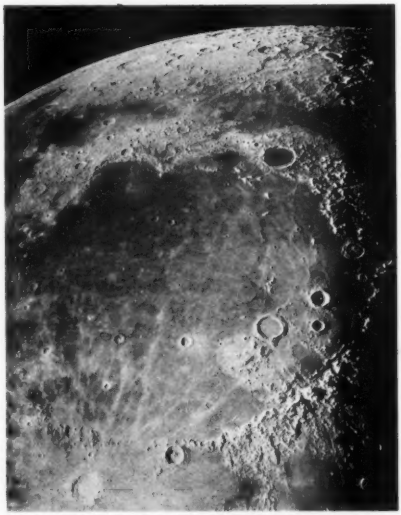

No. 257 from Slide Set LX 30. Northern portion of the Moon at last quarter.

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"Lest We Forget"

T. A. Baldwin, Past-President of the Pacific Section, AAPG in his welcoming speech before that society last November (Pac. Petrol. Geol., vol. 14, No. 12) had a number of very pungent comments to make about geologists. We excerpt the following from his talk—"Unimaginative clods sometime accuse us saying, 'Geology is more of an art than a science'. . . . An artist is a person capable of original and creative thinking, a man, who out of a valueless nothing of facts, creates from his own imagination a new and useful something. . . . A geologist is capable of seizing a few ill related observations and conceiving in three or four dimensions a structure of great utility and beauty. . . . But further, a geologist cannot only create this artistic form, he is privileged to color it with the loviest shades of all—the rich warm browns of oil. . . . It is my proud faith that the mature geologist has basic, native, creative ability and training in the use of that ability. His talents can lead to success in almost any field of employment either in our industry or outside of it. . . ." He went on in his address to say that we had created too many geologists in the post war years, but predicted that the pendulum would swing again.

The creative abilities of the geological scientist who wields his scientific tools in capturing the elusive, obscure understanding of the earth with deftness are not unlike those of a great painter who skillfully manipulates his brushes to create a master piece. A vast amount of scientific information has been accumulated by geologists applying their arts of observation and deduction to the problems confronting them in their great laboratory—the earth. Scientific deduction could carry geologists only so far—they needed better tools of observation and methods of measurement. But, before these could come there had to be break-throughs in other areas of science and engineering. Stirred by military and industrial needs these break-throughs have come to pass, so that geologists can now be armed with the resulting tools and methods with which to mount a new offensive on unsolved geologic problems.

Today there is a rapid trend toward application of quantitative measurements and sophisticated laboratory investigations to problems of geology. This is fine, it is long overdue. However, let us not forget that keen observation and original creative thinking have been among the geologists' best tools—these should be polished up and placed in the new tool kit along with computers, x-ray and other newer approaches to geologic problems.

OUR COVER

CUSS I, drilling barge modified for deep water drilling achieved success in text phases of AMSOC's Project Mohole. NSF Photo. For story see page 10.

The AMERICAN GEOLOGICAL INSTITUTE is a non-profit professional service organization established and managed by the scientific societies in the fields of geology and geophysics in cooperation with the National Academy of Sciences-National Research Council. It is the instrument of the profession serving and advancing the welfare of the geoscientist in matters relating to education, professional responsibilities and government relations. It is an active member of the Scientific Manpower Commission. It also functions in the stimulation of public education and awareness of the earth sciences, through career literature, the scouting program and other channels of communication.

GEOTIMES is the news magazine of the geological sciences. It reports on current events in the earth sciences, public education and public relations efforts throughout the profession, as well as appropriate legislative and governmental issues. It announces scholarships, fellowships, publications and new developments. It provides a forum for discussion of timely professional problems, and affords a common bond between the many specialized groups within the earth sciences.

Economic Development in Africa and Its Mineral Resources

by R. A. Woodtli [1]

With the newspaper columns full of reports on Africa, with the United Nations welcoming new African States by the dozen it is difficult to be unaware of the growing political importance of this continent. Her present economic significance and her potentialities for economic growth consist in a great measure in her mining production and in her mineral resources. The following report is a short survey of the mining industry of Africa.

Tables 1 and 2 provide a summarized account of Africa's position with regard to twenty-six commodities over the last twenty years. It appears that for Africa as a whole significant increases occurred in the actual values of the output of antimony, asbestos, cadmium, chromite, coal, copper, diamonds, gold, iron ores, manganese, nickel, phosphate rocks, platinum, silver and tungsten. Twenty years ago her lead and zinc deposits were considered inadequate whereas now she might account for ten percent of the world output of both these metals. She plays a very important role in the production of minerals like beryl, lithium and uranium which had almost no uses before World War II. She leads the world in the mining of diamonds, cobalt, gold, and platinum ores and is a large producer of antimony, chromite, copper, manganese, phosphate and asbestos. With about 25% of the world reserves of bauxite and about 40% of the world reserves of water power, she is able to expand widely her presently incipient aluminum industry. On the other hand, production of barite, graphite, mercury, tin and vanadium has declined or remained stagnant.

In terms of relative values, or percentages, a comparison is made in Table 1 with the world production in 1938, 1948 and 1959. Figure 1, which includes 16 commodities, shows that between 1948 and 1959 the rate of increase in African production of 12 minerals was higher than that for the world as a whole. It was lower for 3 commodities and grew in the same proportion in one case. It should be noted that in the cases of manganese and phosphate rocks Africa has very large reserves of ores which are being developed at a fast pace; with regard to tin the decrease in output is due to the adoption of quotas of production according to an international agreement.

Present Production

Where is the present production coming from? Figure 2 brings a graphical answer to this question. It is obvious that the bulk of the production is supplied by the area south of the Sahara, mostly by the Union of South Africa and her dependent territory of South-West Africa, then followed by the Rhodesias and the Congo. At the present time the other states occupy a subordinate position. North Africa plays a prominent role with regard to phosphate and, temporarily, iron ores; her production of petroleum, lead and zinc is growing steadily. Between the Equator and the Maghreb extends a strip of continent very poor except for such areas as Nigeria, Ghana and Guinea.

The relationship of Africa to the rest of the world remains predominantly that of a producer of raw material.

Now we shall look at two aspects of this situation: the commercial relationship of Africa with the U.S.A. and the level of her mining industry.

Columns 5 and 6 of Table 1 show respectively the share of African mining production delivered to the United States

[1] R. A. Woodtli, Visiting Research Associate in Geophysics, The Pennsylvania State University; Swiss born and educated; Ph.D. of the Lausanne University (Geology and Petrology). Served ten years in the Congo as Manager of the Dept. of Geology and Cartography of a mining company. Has several publications on African subjects and recently published a book on the *Mineral Resources of Africa*. Laureate of the Royal Academy of Overseas Sciences of Belgium (1956). At State College he is teaching a course on African Mineral Resources.

and the share of Africa in U. S. imports for the same commodities in 1959. Except for diamonds, platinum and tin the table makes no allowance for the commodities which have been processed in some way in Western Europe before being shipped into the U. S. The latter is a particularly important buyer of chromite ores, cobalt, diamonds and platinum; conversely the U. S. depends heavily on Africa for several strategic minerals like antimony, chromite, cobalt, diamonds, manganese, and platinum, to which must be added beryl and lithium.

With regard to the level of her mining industry in Table 2, a simple comparison based on the production per 1.000 km² is made between Africa, the world as a whole and a highly industrialized country (U. S. A.). It is seen that in 8 cases out of 26 (antimony, beryl, chromite, cobalt, copper, gold, phosphate and platinum) Africa leads the world; to that list must be added diamonds (Africa's monopoly for several decades) and lithium. It is remarkable that half of these commodities yield a great value for a relatively small volume. Others like chromite, copper and phosphate are among the most abundant ores in Africa. Very striking is the low level of her production per area in bauxite, coal, iron ores, lead and zinc. This inferiority is emphasized when a comparison is made with the U. S. ratios. Of course we must first make allowance for the well known U. S. deficiency in chromite, cobalt, manganese and tin ores.

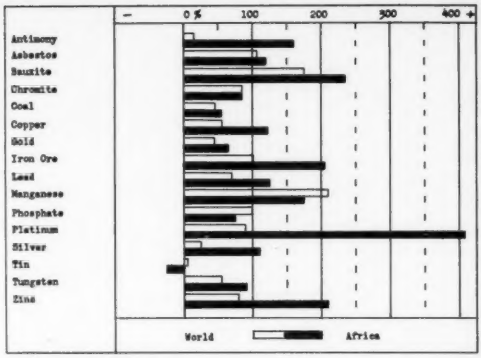

Figure 1. Comparison of increases in World production and African production between 1948 and 1959.

The comparison just made points to the insufficiently developed industrial position of Africa. It also shows that in spite of their long-standing and continued interests in this continent the European powers have not exhausted its mineral resources and have not "exploited" it (using this word in its worst sense). Their efforts have been devoted mainly to the primary process of production and to the acquisition of the basic facilities which are necessary to enable production to increase. These conditions are the basic requirements for economic growth. Another point

Commodity	Share in 1938[1] Per Cent		Share in 1948[2] Per Cent	Share in 1959[3] Per Cent	% of African Output Exported Into the U. S.	Share of Africa in the Total of U. S. Imports %	Africa's Output 1938[7]
Antimony	0.3	Y	12.7	29.1	16.7	36.4	1
Asbestos	16.0	Y	13.9	14.7	13.2	6.3	74.5
Bauxite	--	S	1.6	2.0	--	--	--
Cadmium	+- 6.0	Y	9.3	15.2	4.5	4.3	116 t
Chromite	31.6	Y	31.0	30.9	68.0	57.6	363
Coal	1.2	Y	1.6	1.7	--	--	17,900
Cobalt	?	Y	80.1	74.2	98.0	60.7	
Copper	18.0	S	18.1	25.7	6.8	12.0	395
Diamonds	99.0	Y	96.4	98.0	45.9[4]	79.8[4]	
Gold	40.0	Y	45.2	51.6			454.3 t
Iron Ore	3.9	Y	1.9	2.8	--	--	6,900
Lead	1.3	S	6.5	9.45	11.7	6.8	27.4
Manganese	21.6	Y	22.5	20.1	11.5	36.8	1,131.6
Nickel	0.2	S	0.4	1.0	--	--	0.5
Petroleum	0.08	Y	0.4	0.6	--	--	
Phosphate	36.6	Y	32.9	28.9	--	--	4,400
Platinum	9.2	Y	14.2	38.0	62.5[5]	23.5[5]	2 t
Silver	2.1	S	3.5	5.6	--	3.7	177.9 t
Pyrite	1.0	Y	0.9	3.45	--	--	
Tin	10.8	S	14.7	11.2	8.6[6]	3.6[6]	21.1
Ilmenite	+- 3.3	Y	0.7	7.75	--	--	8.4
Tungsten	1.9	Y	1.9	2.3	24.0	5.8	0.6
Vanadium	47.5		?	19.7	--	--	0.9
Zinc	1.9	S	4.9	7.3	7.2	10.9	10.4

[1] POSTEL, A. W., 1943, *The Mineral Resources of Africa*, Philadelphia

[2] *Minerals Yearbook* (Y) and *Statistical Tables* (S)

[3] *Minerals Yearbook* 1959, preprints

[4] Including imports from Western Europe

[5] Imports from United Kingdom

[6] Including imports from Belgium

[7] *Minerals Yearbook*, in thousands of metric tons unless otherwise indicated. (Zinc = smelter production).

Table 1. Africa's share in World mineral production.

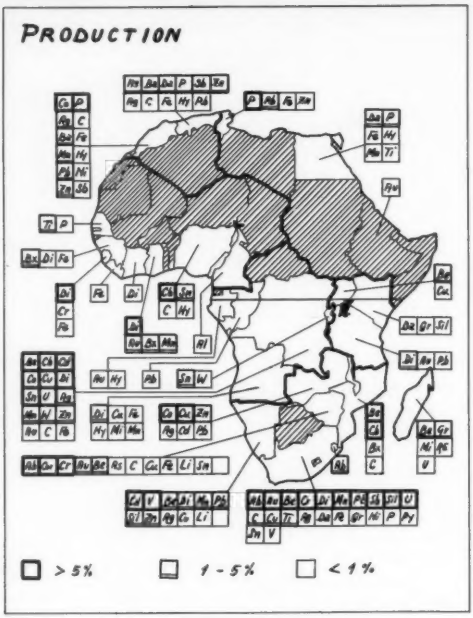

Figure 2. The mineral production of Africa.

Production: KEY 1 = Production over 5% of world output; 2 = Production between 1 and 5% of world output; 3 = production of the area below 1% of world output. Shading = Zones without significant mineral production.

Commodities are indicated by their chemical symbols. Other abbreviations used are: Bx = Bauxite; C = Coal; Da = Diatomite; Di = Diamonds; Gr = Graphite; Hy = Oil; Mi = Mica; Py = Pyrite; RE = Rare Earths; Sil = Sillimanite.

must be stressed: the soil of Africa is very poor and unable to grow as much food and support as much cattle as is desirable. In spite of the statistics of mining production, the apparent wealth of the underground deposits does not compensate for the poorness of the surface. In many cases the ore grade is rather low, the composition is complex and it needs all the skill of the experienced white technicians to make the deposits workable with profits.

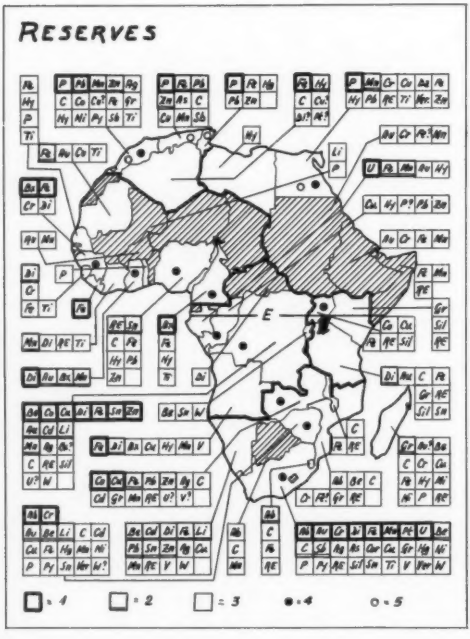

Figure 3. The mineral reserves of Africa.

Reserves: KEY 1 = Very large supply; 2 = large supply; 3 = fair to low supply; 4 = large reserves of hydro-electric power; 5 = large reserves of low grade Uranium ores. Shading = Barren zone with low known mineral resources.

Solid lines divide the continent into six zones: North, North-East, West, Center, East and South.

Commodities are indicated by their chemical symbols. Other abbreviations used are: Bx = Bauxite; C = Coal; Da = Diatomite; Di = Diamonds; Gr = Graphite; Hy = Oil; Mi = Mica; Py = Pyrite; RE = Rare Earths (including Colombium, Tantalum and Thorium); Sil = Sillimanite; Ver = Vermiculite.

Reserves and the Future

The present state of the mining production of Africa has been discussed. We have seen that the relationship of Africa to the rest of the world remains that of a producer of raw materials; in other words, in producing raw materials without consuming them she is in an underdeveloped position. Let us turn now to consideration of the state and distribution of her mineral reserves and industrial development.

Data on ore reserves could be related to production figures to give an estimate of the production life of the continent for the various commodities. Because of the many uncertainties regarding present reserves and because of the economic revolution which is spreading in Africa we refrain from giving here such numerical data, apparently accurate, but in fact highly doubtful.

Figure 3 shows the distribution of mineral reserves among the different states; no attempt has been made to separate equipped and non-equipped reserves; data previously given on present output are indications on actual production capacity. Figure 4 shows the distribution of minerals according to their uses and to six geographical zones. These zones: North, West, North-East, Center, East and South are delimited by solid lines on Figure 3 and have been drawn arbitrarily by the

writer without reference to any existent political or economic pattern. They simply provide a handy basis of comparison. Ranking is based on the amount of known and assumed reserves of each area compared to the world reserves for each commodity. The actual potentialities of Africa as a whole appear in the last column of Figure 4. The distribution of resources brings out great inequalities among the different zones, explains their present level of industrial development and shows roughly what may be expected in the future.

The southern part of the continent has received the greater part of the mineral wealth. A wide variety of minerals, including coal, occurs in the Union of South Africa and in the South-West Africa Territory. The main deficiency is in oil, but

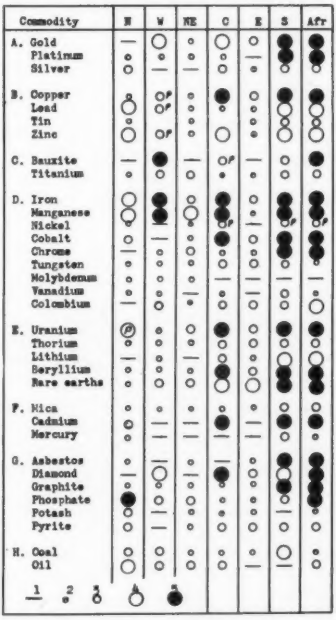

Figure 4. Mineral resources of Africa by geographic zones and commodity uses.

Key of figure N° 4:

Reserves: KEY 1 = No appreciable supply; 2 = low supply; 3 = adequate supply; 4 = large supply; 5 = very large supply; P = potential reserves.

Caption of columns: N = North; W = West; NE = North-East; C = Center; E = East; S = South (including Madagascar); Afr = whole Africa. Divisions according to solid lines of figures 2 and 3.

Classification of commodities: A = precious metals; B = older major metals; C = light metals; D = ferrous and ferro-alloys metals; E = Nuclear metals; F = electronic metals; G = non metallics; H = fuel minerals.

Commodity	World Output		African Output		U. S. A. Output	
	Total	Ton[1] per 1,000 km²	Total	Ton per 1,000 km²	Total	Ton per 1,000 km²
Antimony	47.2*	0.35*	13.7*	0.45*	0.6*	0.06*
Arsenic	42.6*	0.31*	0.5*	0.017*	4.7*	0.5*
Asbestos	2,058.9*	15.2*	302.3*	9.98*	41.0*	4.385*
Bauxite	22,860*	168.8*	456.2*	15.06*	1,727.2*	184.7*
Beryl	6.6*	0.05*	3.2*	0.106*	0.3*	0.03*
Cadmium	8,943	0.07	1,362	0.045	3,905	0.418
Chromite	3,859.3*	28.50*	1,193*	39.37*	95.2*	10.18*
Coal	2,498.3†	18,451†	42†	1,388.4†	393.4†	41,972†
Cobalt	16*	0.12*	11.9*	0.39*	1*	0.106*
Copper	3,646*	26.93*	935.9*	30.89*	748*	80*
Gold	1,331	0.0098	687	0.0227	50.8	0.0054
Graphite	371.9*	2.75*	11.2*		0.37*	
Iron Ore	435,882*	3,219*	12,391*	408.9*	61,240*	6,549.7*
Lead	2,294.7*	16.95*	216.9*	7.16*	231.8*	24.79*
Manganese	12,736*	94.06*	2,565*	84.65*	207.9*	22.24*
Mica	154.4*	1.14*	29.9*	0.989*	90.8*	9.7*
Nickel	283*	2.09*	2.9*	0.096*	10.5*	1.12*
Phosphate	37,114.5*	274.1*	10,708.6*	353.4*	16,122.9*	1,624.4*
Platinum	31.1	0.00023	11.8	0.00039	0.5	0.00005
Silver	6,742.5	0.05	379.4	0.0125	715.3	0.0765
Tin	164*	1.21*	18.4*	0.061*		
Ilmenite	1,731.5*	12.79*	134.2*	4.43*		
Tungsten	51.5*	0.38*	1.2*	0.04*	3.3*	0.35*
Uranium	39,409	0.385	8,054	0.266	14,866	1.59
Vanadium[2]	4,830		952	0.031	3,373	0.36
Zinc	3,075*	22.71*	225.8*	7.45*	385.7*	41.25*

Table 2. Comparison of production per 1000 square kilometers of area in 1959.

* Thousands of metric tons.

† Millions of metric tons.

[1] Excluding Antarctica and Greenland.

[2] Excluding U.S.S.R. According to data of Minerals Yearbook 1959 *(Preprints)*.

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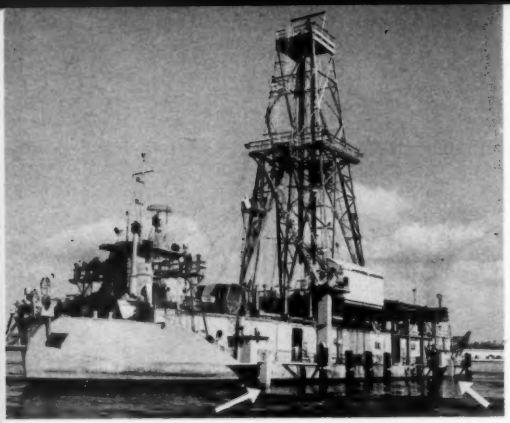
huge reserves of bituminous coal may supply basic material for the extraction of synthetic fuel. Industrialization is making good headway, particularly in the Transvaal where two separate and fully integrated steel works are operated. Its expansion is strongly stimulated by the increasing needs in heavy capital equipment of the gold mining industry which acts as a powerful generator in all sectors.

In the same zone the Rhodesias fulfill also the basic requirements for industrial growth: abundant energy power, iron, copper, chromite, lead, zinc ores, asbestos and coal. In several cases they may rely on their neighbors (Katanga and Mocambique) to make up their deficiencies. Several writers have already considered a big industrial complex amalgamating the famous Copperbelt, the steel works of Que-Que, the chemical plant of Wankie, the Kariba Scheme, etc., in what has nicely been called "Capricorn Africa." But the territories involved are politically divided and tend to move away from each other.

In Central Africa the southern part of the Congo or Katanga shares almost the same assets and liabilities as the Rhodesias. Her resources in manganese are higher but her coal is of a poor quality. An important industry is expanding already around the copper cities. The Rhodesias and the Congo have in common several other limiting factors: high costs of transportation and complete lack of oil.

In the western section of this Central African zone, the Republic of Gabon

(Continued on page 42)



The CUSS I, fitted with the diesel outboards (see arrows) for maintaining position in deep water drilling, lies in San Diego harbor awaiting the start of the first Project Mohole deep water drilling tests. NSF Photo.

They said it couldn't be done . . .

Preliminary Mohole Project Drilling Successful

New vistas in geologic knowledge and petroleum exploration came sharply into focus as the CUSS 1 completed the first phase of the Mohole Project experimental drilling near Guadalupe Island off the coast of Mexico. The specially designed diamond drill bit on a 4½-inch drilling string was lowered over 2 miles through open water from the 3000-ton converted sea-going Navy barge before it made contact with the sea floor at 11,700 feet and began to penetrate the earth's crust.

During the Guadalupe test, the CUSS 1 was lashed by winds of a velocity of up to 35 knots and tossed about by waves 12 to 15 feet high, yet the vessel, with drill pipe turning, did not deviate more than 350 feet from dead center over the hole three miles below.

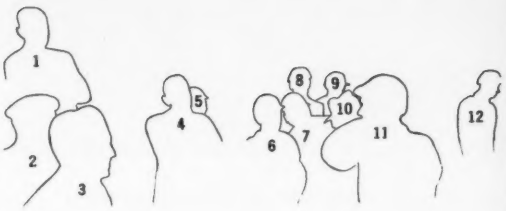
The scientific information brought to the surface in the wire-line core barrel was rather overshadowed by the engineering accomplishments involved in the success of the position holding equipment and the specially adapted drill rig for drilling through the great depth of open water. The importance of these achievements, coupled with the oil industries' first completely remote control underwater oil well completion accomplished recently off the coast of Peru, appears to be the harbinger of exciting opportunities for off-shore oil exploration as well as accelerated scientific research.

The program is being carried out by the National Academy of Sciences—National Research Council, a private organization of scientists, through its AMSOC Committee. Support is by the National Science Foundation, an independent agency of the Federal Government. The drilling has been performed under a $735,800 NSF contract with the Global Marine Exploration Co., of Los Angeles, Calif., aboard its drilling ship, CUSS 1.

The story of project Mohole moved off the drawing board away from smoke-filled committee rooms, away from tap-room scientific debates and out into the San Diego Trench off La Jolla, California in mid-March when CUSS 1, specially modified for the deep water preliminary Mohole Project drilling, obtained the first deep-water rotary cores from sediments lying at a depth about 3000 feet below the ocean.

In the first hole off La Jolla which penetrated between 200 and 300 feet, several punch cores were recovered. In the second hole, after recovering cores of poorly consolidated fine sands to coarse silts of the turbidity current type of deposits with considerable fossil content, the drill encountered a more resistant zone of carbonate rock at 760 feet. X-ray analysis of core samples from this zone by Ed Goldberg of Scripps showed the rock to be dolomitic. The drill passed back into softer sands and silts below the carbonate zone. The age of the rocks encountered

AMSOC Committee Members aboard the CUSS I in San Diego harbor before the San Diego Trench test drilling are briefed by Don Woodward. Photo by Fritz Goro, Life Magazine.



1. Willard Bascom, Project Director, NAS-NRC
2. William B. Heroy, AMSOC Committee, Geo-Tech. Corp.
3. George Homonick, International Drilling Co.
4. Warren Brooks, AMSOC Committee, Socony-Mobil.
5. Jack McLelland, AMSOC staff, Chief Engineer
6. Harry S. Ladd, AMSOC Committee, U.S.G.S.
7. Maury Brodrick, U. S. Information Agency
8. William E. Benson, National Science Foundation
9. Edward Horton, AMSOC Staff
10. Arthur Lubinski, AMSOC Drilling Panel
11. C. Don Woodward AMSOC Drilling Supervisor, Texico
12. Russell Thornburgh, Project Manager, Global Marine Exploration Co.

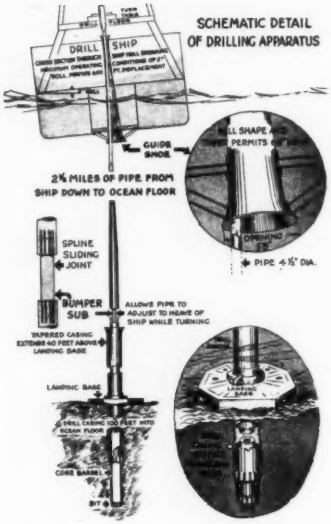
has not been definitely ascertained. It is speculated, however, that the rocks above the dolomitic zone may be Pleistocene and that below this zone the drill may have penetrated Pliocene deposits. Cores were obtained at 230, 240, 330, 500 and 760 foot levels but the hole was abandoned at a depth of 1043 feet below the ocean floor after the wire-line core barrel had been lost.

The San Diego Trench preliminary drilling offered the first specific proof that four 200-horsepower diesel outboards controlled by a steering console with a special radar and sonar buoy system could hold the barge within a reasonable range of the drill hole on the ocean floor. So, after several days in port, the CUSS 1 then was moved to the site off Guadalupe Island for the first major deep water drilling test.

Positioned in 12,000 feet of water, the rig drilled a trial hole which penetrated several hundred feet into the soft sediments of the sea floor and several punch cores were recovered. The drilling of the second, epic-making hole began on March 31; coring started at 490 feet. Between 490 and 560 feet cores of soft, gray-green clay were recovered containing fossils identified by AMSOC geologists aboard as Miocene.

At the 560 foot level the drilling speed dropped off abruptly and the core barrel when retrieved was found to contain hard, fine-grained vesicular basalt. The occurrence of basalt at this level beneath the ocean floor appears to coincide with the sharp seismic velocity change which has been reported by geophysicists and has been subject to speculative interpretation. Several cores of basalt were recovered from the hole before it was abandoned at a depth of 601 feet. Ironically for the critics of the Mohole Project, this important contribution to geologic knowledge came on April 1.

A third Guadalupe hole concentrated on obtaining the core record from 260 feet and 460 feet at which depth it was terminated.


SCHEMATIC DETAIL
OF DRILLING APPARATUS
DRILL SHIP
GUIDE SHOE
2¾ MILES OF PIPE FROM SHIP DOWN TO OCEAN FLOOR
SPLINE SLIDING JOINT
PIPE 4½" DIA.
BUMPER SUB
ALLOWS PIPE TO ADJUST TO HEAVE OF SHIP WHILE TURNING
TAPERED CASING EXTENDS 60 FEET ABOVE LANDING BASE
LANDING BASE
DRILL CASING 100 FEET INTO OCEAN FLOOR
CORE BARREL
BIT

STAFF FOR THE EXPERIMENTAL DRILLING PROGRAM

Willard Bascom, Project Director
Jack I. McLelland, Chief Engineer
C. Don Woodward, Drilling Superintendent
William Riedel, Chief Scientist
Edward Horton, Staff Engineer (Drill pipe)
Francois Lampietti, Staff Engineer (Theory)
H. E. Ohanian, Staff Engineer (Sonar-Radar)
Robert Snyder, Staff Engineer (Instrumentation)
Peter Johnson, Staff Naval Architect
Jeff Savage, Scientific Liaison
Charles Wakefield, Special Assistant on Drilling Problems
Robert Taggart, Consultant

The cores from the Guadalupe test drilling have furnished abundant material for paleontological studies. As much as 80 per cent of the green, upper Miocene ooze brought to the surface in the cores consists of fossil remains. It has been tentatively estimated that these deposits accumulated at the rate of about two centimeters of ooze per thousand years. Organic remains are less abundant in the uppermost portion of the 500 foot section of sediments.

The scientific team concentrated on geophysical measurements in the fourth Guadalupe testhole. At a depth of 140 feet, the measured temperature was 7°C. and at 500 feet was 21°C. Although this area was known from previous studies to have a higher than average heat flow, the readings obtained indicated the rate to be higher than anticipated.

Geophones were lowered into the hole to measure the velocity of waves from a series of underwater charges set off by the auxiliary ship, *Orca*, from Scripps. The velocity of 1.59 kilometers per second obtained for the green ooze was somewhat lower than had been expected by seismologists. The inference is that the thickness of ocean bottom sediments may be generally less than formerly thought.

AMSOC COMMITTEE

William Bates	Arthur E. Maxwell
William B. Heroy	Walter Munk
J. B. Hersey	Roger Revelle
Harry H. Hess	William W. Rubey
Harry S. Ladd	Harold E. Sanders

Joshua I. Tracey, Jr.

Gordon G. Lill, Chairman

Willard Bascom, Technical Director

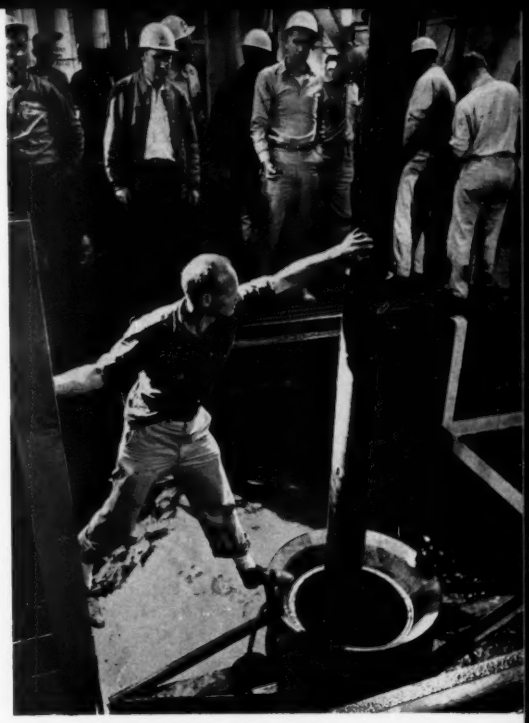
A magnetic survey was run in the hole. A caliper survey indicated that there was considerable caving of the walls.

The last phase of the preliminary drilling tests for Project Mohole at the Guadalupe site was the experimental testing of a French turbodrill. The conventional rotary was replaced by the hydraulic driven turbodrill lowered on the drill string. The turbodrill was driven at a rate of 750 r.p.m. by sea water pumped from the surface through the drill string at 1,750 p.s.i. A diamond bit was used and several wireline cores were recovered from the contact between the basalt and the overlying sediments.

The scientific teams were successful in securing important ocean current data at the Guadalupe test site as the drilling was concluded.

The Guadalupe test drilling was concluded on April 12 and the CUSS I was towed back to San Diego. Project Mohole, armed with new data and ideas, went back onto the drawing board and into another round of committee meetings devoted to planning the all-out offensive on the Mohorovicic discontinuity.

Dr. Detlev W. Bronk, President of the Academy-Research Council, commenting on the achievement, said, "The scientists and engineers associated with the Mohole Project have accomplished an extraordinary feat of ingenuity, skill, and daring in proving the practicability of drilling into



Doug Inman collects mud from drill stem as the bit is pulled from the first hole drilled off La Jolla in the San Diego Trench. Photo by Fritz Goro, Life Magazine.

the deep ocean floor to a greater depth than man has ever gone before. Years may be required to evaluate fully the significance of this achievement but we already have spectacular evidence that science now has a remarkable new means for discovery."

Gordon Lill, chairman of the AMSOC Committee, observed, "We are witnessing the opening of the deep ocean basins to true exploration and eventual exploitation for scientific and economic purposes. In this sense most of the earth still lies before us thus far untouched. It lies beneath the deep sea."

M. N. Bramlette (Scripps), Harry S. Ladd and J. I. Tracey, Jr. (USGS) and William R. Riedel (Scripps) will be responsible for petrologic and paleontologic studies of the Guadalupe cores. Geophysical logging will be made by G. V. Keller and C. Zablocki (USGS); geothermal measurements—R. P. von Herzen (Scripps) and A. E. Maxwell (ONR); biochemical and bacteriological investigations—S. C. Rittenberg and K. O. Emery (USC); strength and compaction of sediments—D. G. Moore and E. L. Hamilton (Navy Electronics Lab.); physical character of rocks—I. Fatt, S. H. Ward and W. H. Somerton (Univ. of Cal.-Berkeley). Francis P. Shepard and Douglas L. Inman of Scripps will conduct investigations of the general petrology of the cores from the San Diego Trough drilling.

Despite the spectacular success of the Guadalupe tests a tremendous amount of engineering, planning and development must take place before the supreme effort can be mounted in quest of the Mohorovicic discontinuity. Even if this objective is never ultimately attained, the challenge presented to scientists and engineers in their efforts to reach the mysterious layer of demarcation between the crust and the mantle has resulted already in a major breakthrough in the methods of geologic exploration for that three-quarters of the earth which lies hidden beneath the sea.

Doug Inman (left) and Walter Munk collect a sample from the wire-line core barrel aboard the CUSS I off the California coast at La Jolla. Photo by Fritz Goro, Life Magazine.

ASCM Resolution on Mapping

Citing the inadequacies of American mapping programs over the past hundred years the following resolution of the 21st Annual Meeting of the American Congress on Surveying and Mapping, March 24, 1961, was approved and directed to the attention of the President of the United States:

WHEREAS 17 separate investigations authorized by the Presidents of the United States and the Congresses since 1843 have expressed consistently the need for adequate Federal surveying and mapping programs to provide basic geodetic and topographic data; and,

WHEREAS the U.S. Presidential Advisory Committee on Water Resources Policy of 1955 recommended the completion within certain periods of years of basic geodetic control surveys and basic topographic mapping and other kinds of surveys for the Nation; and,

WHEREAS the U.S. Presidential Advisory Committee on Minerals Policy of 1954 recommended the acceleration of the basic surveying and mapping programs of the Federal Government; and,

WHEREAS the multi-billion dollar Interstate Highway Program was conceived and commenced without benefit of adequate surveys and maps for planning; and,

WHEREAS the American Institute of Planners in 1961 expressed an urgent need for maps of urban and city areas at a scale of 1:24,000 for general planning purposes, as well as certain maps at several larger scales, for more detailed planning relative to social, economic, and cultural development; and,

WHEREAS in the U.S. President's Special Message to Congress on Housing and Community Development he stressed the importance of urban development, urban renewal, and metropolitan redevelopment, which for efficient, economical and intelligent planning requires up-to-date and accurate survey map data before final planning is completed and development commences; and,

WHEREAS many eminent organizations, including the U.S. Chamber of Commerce and the American Society of Civil Engineers, have stressed repeatedly the importance of having basic surveys and maps of our country;

WE DO THEREFORE HEREBY RESOLVE that we do once again clearly and resolutely affirm the need at a very early date to complete basic surveys and maps of the United States and its outlying areas of sovereignty and jurisdiction, without which surveys and maps efficient, economical, and intelligent national plans, projects, and programs cannot be accomplished.

UBIQUITOUS COESITE

The brightest new star in space mineralogy is coesite, the dense, highly stable form of silica which as recently as one year ago was thought to exist only under high temperature and pressure conditions in the laboratory.

Coesite was first identified as ocurring in nature when it was found by E. C. T. Chao in sheared sandstones collected at Meteor Crater, Arizona by E. M. Shoemaker *(GeoTimes, Sept. 1960)*. Subsequently it was found in the huge German impact crater, the "Rieskessel".

Recently coesite was again reported in samples collected by the University of Texas tektite specialist, Virgil Barnes, from a small iron meteorite crater near Al Hadida in east central Saudi Arabia.

Coesite, man-made in nature, has also been found in the Teapot Ess Crater resulting from a 1.2 kiloton atomic test explosion discharged under 67 feet of alluvial cover at the Nevada Test Site in 1955.

Indications are that the amount of coesite developed in an impact crater appears to vary direct with the size of the crater and the intensity of the impact energy. To date coesite has not been identified in tectonic and volcanic environs.

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Geology Degrees During the Decade of the Fifties

by CLARENCE B. LINDQUIST [1]

During the decade of the 1950's the number of bachelor's degrees in geology declined from a high of 3,043 in the year ending 1950 to 1,632 in the year ending June 1954, and then rose steadily again to 2,816 in the year ending June 1959. Although the number awarded in later years of the 1950's did not reach the number of the peak year ending in June 1950, nevertheless the percentages of bachelor degrees awarded in geology based upon the total number of bachelor's and first-professional degrees awarded were higher in the later years, with a high of 0.762 of 1 percent reached in the year ending June 1958.

Year Ending June 30	No. of Degrees Conferred in Geology	Geology as a Percent of all Degrees Conferred at Same Level [1]	No. of Geology Degrees Awarded to Men	No. of Geology Degrees Awarded to Women	Percent of Geology Degrees Awarded to Women	No. of Institutions That Conferred Degrees in Geology [2]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
			BACHELOR'S DEGREES			
1950	3,043	.702	2,934	109	3.6	-
1951	2,717	.725	2,643	74	2.7	-
1952	2,102	.633	2,026	76	3.6	-
1953	1,719	.564	1,651	68	4.0	-
1954	1,632	.557	1,553	79	4.8	-
1955	1,795	.625	1,703	92	5.1	189
1956	2,138	.705	2,060	78	3.6	192
1957	2,548	.749	2,459	89	3.5	200
1958	2,788	.762	2,684	104	3.7	199
1959	2,816	.731	2,725	91	3.2	206
			MASTER'S DEGREES			
1950	493	.847	477	16	3.2	-
1951	565	.867	543	22	3.9	-
1952	486	.764	469	17	3.5	-
1953	517	.847	509	8	1.5	-
1954	412	.725	397	15	3.6	-
1955	507	.871	481	26	5.1	86
1956	491	.870	478	13	2.6	75
1957	548	.885	532	16	2.9	80
1958	700	1.067	679	21	3.0	89
1959	643	.925	630	13	2.0	89
			DOCTOR'S DEGREES (Ph.D., Ed.D., etc.)			
1950	113	1.704	110	3	2.7	-
1951	123	1.676	120	3	2.4	-
1952	116	1.510	116	0	0.0	-
1953	133	1.601	130	3	2.3	-
1954	136	1.512	130	6	4.4	-
1955	154	1.742	152	2	1.3	35
1956	128	1.584	127	1	0.8	35
1957	129	1.473	127	2	1.6	37
1958	136	1.521	133	3	2.2	34
1959	184	1.966	179	5	2.7	41

[1] For example, the percent at the bachelor's level is based upon all bachelor's and first-professional degrees conferred that year.

[2] Counting of the number of institutions that conferred degrees in separate disciplines was not begun until 1955.

Table 1. Number of degrees conferred annually in geology 1950-1959.

The number of master's degrees awarded remained rather steady during the 10-year period, with a slight increase during the last two years, the high number being 700 conferred in the year ending June 1958. The number of doctorates tended to increase slightly during the decade, with a

[1] DR. CLARENCE B. LINDQUIST, Chief for Natural Sciences and Mathematics, Division of Higher Education, U.S. Office of Education, Washington, D.C.

Level	% of geology degrees awarded to women	% of all physical science degrees awarded to women	% of all degrees awarded to women
(1)	(2)	(3)	(4)
Bachelor's and first-professional	3.7	11.6	32.0
Master's except first-professional	3.1	7.9	32.0
Doctorate (Ph.D.,Ed.D.,Etc.)	2.1	3.7	9.8

Table 2. The percent of degrees awarded to women during the 10-year period 1950-1959, by level of degree.

low of 116 in the year ending June 1952, and a high of 184 in the year ending June 1959.

Ten-Year Totals and Percents

Over the 10-year period as a whole, 23,298 bachelor's degrees were awarded, constituting 0.677 of 1 percent of all bachelor's and first-professional degrees awarded. Comparable figures at the master's level were 5,362 degrees and 0.866 of 1 percent and at the doctorate level, 1,352 degrees and 1.614 of 1 percent, respectively. Thus, it is seen that geology increases at each higher level its percentage of the total number of degrees conferred at each level.

The details of the number of degrees in geology awarded annually at each level are portrayed in Table 1. Geophysics degrees, which are relatively few in number, are not included. The data in this table and others in this article were compiled from the annual series of *Earned Degrees Conferred by Higher Educational Institutions* published by the U. S. Office of Education. Each annual report covers a period of time from July 1 of one year, to June 30 of the next. Double majors are counted as one-half in each discipline. Thus, a double major by a student in geology and chemistry is allocated one-half to geology and one-half to chemistry.

The reader will note that the counting by the Office of Education of institutions which each year conferred degrees in various disciplines at the three levels did not commence until the year ending June 1955. On the average, slightly less than 200 institutions annually awarded bachelor's degrees in geology, about 85 awarded master's degrees, and about 35 awarded doctorates.

Degrees Awarded to Women

In Table 1 columns (4) and (5) give the number of degrees awarded to men and women, respectively, during each year, and column (6) gives the percent for each year of the number of degrees awarded to women compared to the total number of degrees awarded to both men and women at each level. The comparison for the entire 10-year period between the percent of geology degrees awarded to women and the percent of all physical science degrees, as well as the percent of all degrees awarded to women, is shown in Table 2. It is seen that geology is essentially a man's field. At the bachelor's level for the 10-year period, only 3.7 percent of the geology degrees were conferred upon women, at the master's level 3.1 percent, and at the doctorate level 2.1 percent. The percent of geology degrees awarded to women is even considerably lower, for each level, than the percent for women in the physical sciences as a whole.

Number of Doctorates

Table 3 shows the number of doctorates in geology awarded annually by individual institutions for each year ending June 30, during the period 1950-59, as well as the total number of such degrees conferred during this period. The 54 institutions which awarded the degrees are ranked in decreasing order based upon the total number of doctorates in geology conferred during the 10-year period. Columbia University heads the list with a total of 143, followed by the University of Wisconsin with 88 and Harvard University with 87. The first eight institutions in the list awarded only 1 less than the total number of doctorates in geology awarded by the remaining 46 institutions.

Several institutions which did not confer the doctorate in geology during the 1950's will do so during the 1960's. Under Title IV of the National Defense Education Act of 1958, the U. S. Office of Education is providing financial support, including fellowships, for new doctoral programs in geology at Florida State University, Montana State University, University of Oregon, and Brown University.

Table 3. Number of doctorates in geology conferred by individual institutions, 1950-1959.

(In decreasing order based upon 10-year total)

Rank Order	Institution	10-yr. Total	Year Ending 1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
1	Columbia U.	143	12	11	7	15	16	23	14	16	14	15
2	U. of Wisconsin	88	7	7	10	9	9	15	6	8	8	9
3	Harvard U.	87	14	7	9	12	7	10	5	8	5	10
4	U. of California (all campuses)	77	2	11	7	8	14	6	7	6	4	12
5	Stanford U.	73	5	6	7	9	4	5	12	5	6	14
6	U. of Illinois	71	6	4	2	5	4	9	5	5	17	14
7	Princeton U.	70	6	13	6	7	6	5	6	7	8	6
8	U. of Chicago	66	4	12	9	5	8	5	7	5	5	6
9	Yale U.	64	5	8	6	6	5	7	4	3	8	12
10	Mass.Inst. of Tech.	53	3	8	9	6	7	8	3	2	3	4
11	Cal. Inst. of Tech.	42	6	3	3	4	7	5	2	7	2	3
12	U. of Michigan	41	6	4	1	2	7	4	2	5	4	6
13	Johns Hopkins U.	38	5	2	2	6	3	5	6	5		4
14	U. of Washington	34		1	3	2	3	4	3	4	4	10
15	U. of Minnesota	33	5	1	5	3	4	1	4	3	2	5
16	Ohio State U.	31	3	3	5	2	1	4	4	3	3	3
17	Cornell U.	25	2	4	4	4	2	4		2	1	2
18	U. of Arizona	22	2	1				4	3	3	3	6
18	Indiana U.	22		1	2	2	3		6	4	3	1
18	State U. of Iowa	22	3	2	4	1	3	1	4	1	3	
18	U. of Texas	22	2		4	3	1	1	1	2	7	1
22	Northwestern U.	19		1	1	1	3	3	2	3	4	1
23	U. of Colorado	17	1	1	1	1	1	3	3	2	1	3
23	Louisiana State U.	17	2			3		4	3		1	4
25	U. of Kansas	15		3		1	2	2	2	1		4
26	U. of Missouri	13	3		2	1				1	2	4
26	U. of Utah	13		1			2	3	2		3	2
28	U. of So. Calif.	12	1	1		1	1		1	3	3	1
28	U. of Oklahoma	12			2	2	1	2	2	1	1	1
30	Rutgers(The State U.)	11		1	1	1	1			4		3
31	Washington U. (St. Louis)	9	1	1	1			2	2	1	1	
31	Lehigh U.	9	1	2						2	2	2
33	Boston U.	8					2			1	2	3
33	U.of No.Carolina	8	1			1	3	1			1	1
35	Penn.State U.	7				4		1	1	1		
36	St.Louis U.	6	2	1		3						
36	U. of Cincinnati	6	1	1		1			1	1		1
36	U. of Wyoming	6						2	1	1		2
39	Wash. State U.	5	1				2	1	1			
40	Syracuse U.	4			2	1		1				
40	Bryn Mawr	4	1									3
42	Iowa State U.	3							1	1		1
42	Radcliffe College	3				1	2					
42	U. of Nebraska	3					1	1	1			
42	Rice U.	3									1	2
42	Virginia Poly.Inst.	3								1		2
47	Michigan State U.	2								1	1	
47	U. of Pittsburgh	2						1				1
47	West Virginia U.	2							1	1		
50	U. of No. Dakota	1		1								
50	U. of Rochester	1			1							
50	U. of Tennessee	1										1
50	U. of Alaska	1						1				
50	Texas A & M	1										1

Geomorphological Abstracts

Professor Keith M. Clayton, Department of Geography, London School of Economics is the editor of *Geomorpohlogical Abstracts*, a relatively new British Journal issued four times a year (price—16s/-). The Journal will probably contain about 500 abstracts of papers on geomorphology in 1961.

The editor, Professor Clayton, is currently at Harpur College, Binghamton, New York as a Fulbright Professor.

Persons desiring additional information on the journal should write *Geomorphological Abstracts, c/o Department of Geology, London School of Economics, Houghton St., Aldwych, London, W. C. 2.*

The Geological Society of America

by FREDERICK BETZ, JR.

On December 27, 1963, The Geological Society of America will reach its 75th birthday. The GSA can trace its lineage directly from the Association of American Geologists, founded April 2, 1840. In the intervening 48 years that organization had first, in 1843, become the Association of American Geologists and Naturalists, and then, in 1848, been transformed into the American Association for the Advancement of Science. Within the AAAS, geology obtained organizational identification again in 1882 with the creation of Section E. By this time, however, a demand for an autonomous geological society had emerged. The formal organization of the American Geological Society in 1888 at Ithaca, New York, culminated seven years of effort by a small group of geologists to convert interest into active support. The Society's name assumed its present form in 1889. In the provisional constitution of 1888, Original Fellows were defined as "working Geologists and Teachers of Geology who are now members of the American Association for the Advancement of Science." Thus, there can be no doubt about the unbroken line of descent. When, in 1963, the GSA celebrates its 75th anniversary, it can also claim an age of 123 years as the scientific society of American geologists.

MAJOR FUNCTIONS

Age alone is not necessarily a mark of distinction. The GSA claims a position of eminence among geological societies on the basis of its contributions to the promotion of the science of geology. Foremost among the Society's contributions are its publications, which are distributed throughout the world. The Society observes from a sampling of literature published by itself and other organizations that papers published in its monthly Bulletin are more widely cited by researchers than those of any other geological journal in the English language. The Bulletin, now in its 72nd volume, offers about 2,000 pages of scientific reporting annually. The GSA has published 83 volumes of Memoirs, beginning in 1934; 64 volumes of Special Papers from 1934 to 1958, inclusive; from 1954 to the present, 9 volumes of a Treatise on Invertebrate Paleontology; 23 volumes of an annual Bibliography and Index of Geology exclusive of North America; and various special volumes, pamphlets, guidebooks, and maps. The magnitude of this publication effort can be judged in part from the number of pages printed. For example, the

EDITOR'S NOTE

This article about the Geological Society of America by Dr. Frederick Betz, Jr. is the first of a series on the Member Societies of the American Geological Institute to appear in future issues of GeoTimes.

Frederick Betz, Jr., the author, is Secretary of the Geological Society of America with headquarters in New York City.

SOCIETY OF NATURAL SCIENCES.

Office of the Director of the Museum.

Buffalo, _____ 1

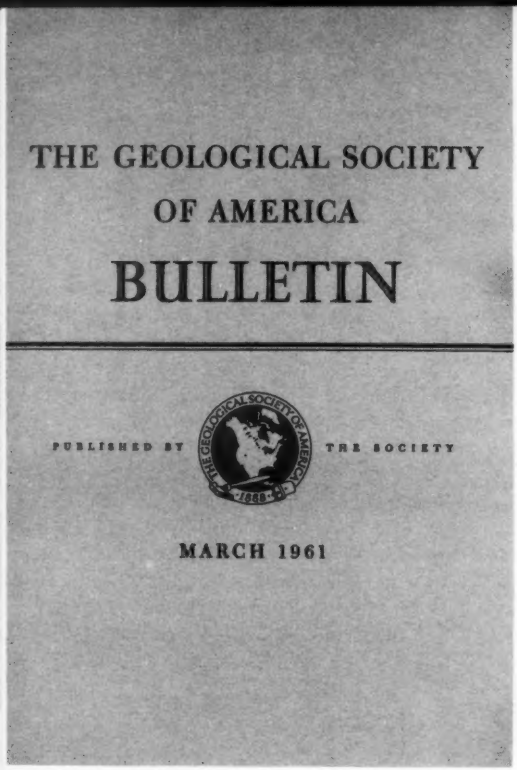
Pursuant to a call the Geologists of the A.A.A.S. met in Cleveland, High School on Aug. 14. 1888. Prof A. Winchell was elected chairman and Dr Julius Pohlman secretary. The meeting was called for the purpose of organizing a Geological Society of America. It was claimed that the meetings of the A.A. did not give to the Geologists the time necessary for a full discussion of many important problems in that branch of science. Profs. Hitchcock, N.H. Winchell, H.S. Williams, A. Winchell J.S. Stevenson, Cooke and many others engaged in a very full discussion as to the best ways and means of establishing such a society without conflicting with the interests of the A.A.A.S., which was ended by Prof. John R. Proctor's motion: "That the Geologists present consider it advisable to form an American Geological Society." The motion was carried unanimously.

Prof. H.S. Williams then offered the following resolution:

"Resolved that it is the sense of the geologists here assembled that the original membership of this society should be constituted of active workers in and teachers of geology who are members of the A.A.A.S."

The motion was carried.

Facsimile of a portion of the minutes reporting on the organizational meeting of the Geological Society of America in 1888.



Bulletin and Proceedings of the Society have totaled 83,600 pages; the Memoirs, Special Papers, and Treatise on Invertebrate Paleontology have accounted for 40,000 pages, and the "Foreign" Bibliography has already covered 11,900 pages. Most of the publications are volunteered manuscripts. The Society adheres to a policy of accepting for publication all material judged by critical reviewers, generally drawn from the membership, to be scientifically sound and worthy of dissemination. The influx of acceptable manuscripts has increased sharply in recent years, with the result that the publication resources have been taxed beyond their capacity to keep abreast of the supply. The Society is fully cognizant of the need for meeting this problem with constructive measures that will provide prompt, broad coverage of new scientific findings and discussions in the geologic sciences. Steps are being taken to reach this goal as soon as possible. Invited manuscripts constitute a small, but important feature of the Society's publications. Among the books in this category have been the 50th Anniversary Volume and the Berkey Volume (Application of Geology to Engineering Practice). The majority of Review Articles, published in recent years in the Bulletin, have also been prepared by selected authors. The Society's own activity in preparation of material for publication is exemplified by the "Foreign" Bibliography, which has won international repute for its excellence among scientific bibliographies.

The GSA augments its publication function by providing a forum for the presentation and discussion of research and other subject matter of interest to geologists and scientists in related fields. As with the demand for publication, the requests for a place in the meeting programs have grown to record proportions, exceeding the available time and facilities. The published abstracts of papers presented at the different meetings sponsored annually as permanent evidence of the scope of these programs.

A third facet of the Society's contribution to promotion of geology has been the financial support for the performance of research proposed by applicants for such aid. In the last 28 years, since this support was instituted, 983 grants have been made totaling more than $1,400,000. The aid rendered today is relatively slight, when compared with the munificence of governmental and other private sponsors of scientific research, but it continues to be a benefit especially to beginners in research, who have limited access to sources of larger individual grants.

The ability of the GSA to perform its present functions and make its contributions was enhanced by the generosity of Richard A. F. Penrose, Jr., who bequeathed a sizeable fortune to the Society. Even today, almost 30 years later, with greatly changed financial conditions facing a much enlarged membership, the income from the Penrose Endowment Fund is the main single support for the Society's operations.

Organization

The Society is governed by a Council of 17 Fellows, comprising 12 Fellows serving three-year terms and 5 Fellows with one-year terms. The latter include the current Officers (the President, Vice-President, Secretary, and Treasurer) and the Past President. The Council (and Officers) are elected by the Fellowship. The Council meets twice a year to act on policy and business of the Society. It is supported by appointed advisory groups, including 11 standing committees, other special committees, and representatives. The Council is represented between its stated meetings

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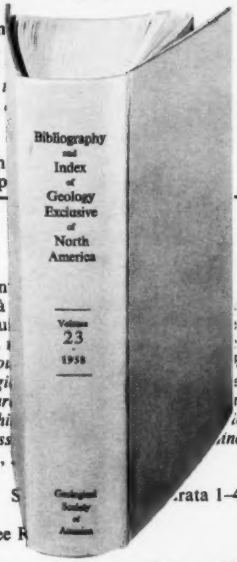

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See also Colom 1,

Murashita, Toshio. S .rata 1–4.

Muratov, V. N. See R

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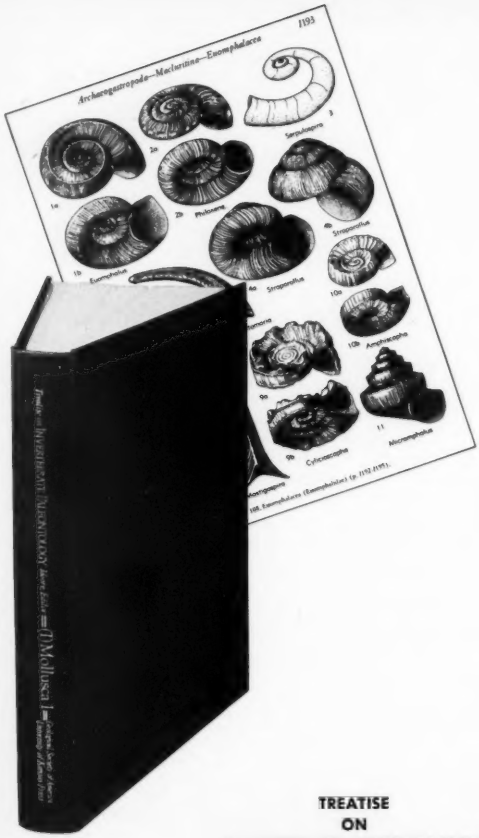
BIBLIOGRAPHY AND INDEX OF GEOLOGY EXCLUSIVE OF NORTH AMERICA

by the Executive Committee, which consists of at least three Councilors. The Society's business is conducted mainly through its headquarters, which has a staff administered by the Secretary. For example, under his direction, the Society's publications are issued and distributed, the records of the Society and its membership are maintained, the Council and Committees are provided with data necessary for the conduct of their affairs, and the meetings of the Society and its Sections are given support in technical arrangements and in preparation and distribution of programs. The participation of the membership in the Council, Committees, and bodies of other units of the organization ranges from about 125 to 150 in any year. The provisions in the Bylaws and the accepted policies for selection of Councilors, Committeemen, and other representatives of the membership lead to a distribution of responsibilities.

The Society holds an Annual Meeting, scheduled in recent years in late October or November. This meeting is held at a location chosen by the Council, generally from invitations by local groups of members, who signify their willingness and ability to prepare and conduct the meeting. In the early years of its history, the Society held two meetings annually as a rule. The sites chosen then were almost always in the eastern United States or Canada, whereas today they are scattered as widely as possible.

Regional Sections

In 1899, Fellows in the western United States felt that their isolation from the rest of the membership and the distance to annual meeting sites justified the hold-



ing of regional meetings. The Cordilleran Section was created with the approval of the Council and has, except in a few years, held regular annual meetings. The Rocky Mountain and Southeastern Sections were formally approved in 1947. All the Sectional meetings are held in the Spring. These three sections identify all members of the Society within their respective geographic limits as their members, but their meetings are open to all members of the Society for attendance and participation.

Topical Groups and Division

Within the Society are three organized groups of members representing branches of geology, namely, the Groups on Coal Geology, Geomorphology, and Hydrogeology. An important application of geology is represented in the Society's Division on Engineering Geology. The Groups and Division conduct various types of activities, principally in the organization of programs for inclusion in the meetings of the Society. The Division on Engineering Geology has been active also in preparation of teaching and reference material and in maintaining liaison for the Society with engineering organizations. Any member of the Society can affiliate with any Group or the Division at his own request. No additional dues are collected, but these four groups are permitted to collect funds for special activities.

Affiliations

The GSA maintains close relationship with several distinct organizations, which are identified as Associated Societies. They are the Mineralogical Society of America, the Paleontological Society, the Society of Vertebrate Paleontology, the Society of Economic Geologists, the Seismological Society of America, and the National Association of Geology Teachers. The Associated Societies meet with the Society or its Sections frequently or regularly, and the programs and abstracts of these joint meetings are published by the Society. The GSA is, in turn, an affiliate of the American Association for the Advancement of Science. It co-sponsors the programs of Section E at the Annual Meetings of the AAAS and prints the schedules and abstracts.

Honors

The GSA awards the Penrose Medal "in recognition of eminent research in pure geology" identified by "outstanding original contributions or achievements which mark a decided advance in the science of geology." This medal was made possible by a gift from Richard A. F. Penrose, Jr., in 1927. The Society also designates recipients of the Day Medal, established in 1948 by Arthur L. Day for recognition of "outstanding achievement in contributing to geologic knowledge through the application of physics and chemistry to the solution of geologic problems." Third, the Society administers the Kirk Bryan Award, presented first in 1958, "to the author or authors of a published paper of distinction advancing the science of geomorphology or some related field, as Pleistocene geology." As a rule, the awards are made annually, Recipients need not be members of the Society nor residents of North America. Finally, the Society recognizes "persons distinguished for their attainments in geological science and not resident in North America" by election to the honorary rank of Correspondent. Currently, the number of Correspondents approximates 60.

Membership

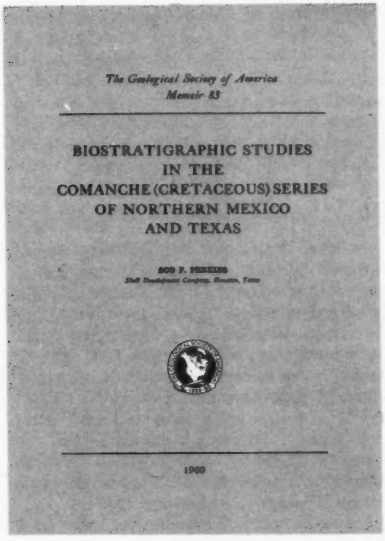
When the GSA was organized in 1888, it could list 112 Original Fellows. The number of Fellows was increased by elec-

tion to about 200 in the next five years. The membership then comprised virtually the census of all active geologists in the United States and in North America. Thus, the GSA was a truly representative society and its meetings and publications disseminated the sum of geologic research in this continent.

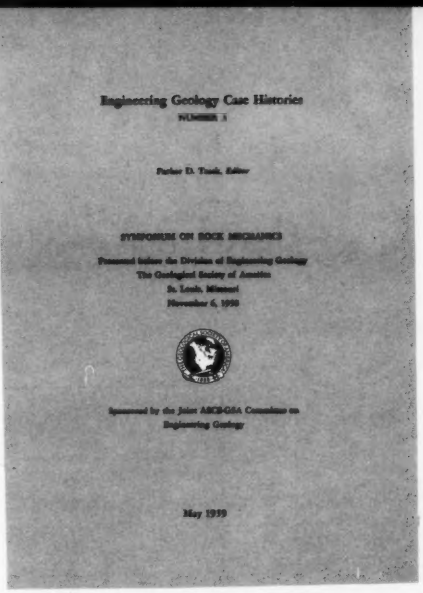
In the ensuing decades the growth in membership was slow. In 1913, the 25th anniversary of the Society, the membership was only 374. The 50th anniversary, in 1938, showed a count of 743 Fellows. Despite the small size of the membership in 1938, it was almost seven times the original membership. Nevertheless, the increase had not kept pace with the increase in geologic population, particularly during the upsurge of geologic activity after World War I.

After 58 years with a single class of membership, the GSA in 1947 added the class called Member. In that year, seven Members were elected and the number of Fellows was 1050. At the end of five years with two classes of membership, the Members totaled 1288, while the Fellows numbered 1335. In 1957, the tenth year, there were 2954 Members and 1588 Fellows. Currently, at the beginning of 1961, the total has risen to 5492, of which 3783 are Members and 1709 are Fellows.

The present membership includes 4816 Fellows and Members in the United States,



MEMOIR SERIES



ENGINEERING GEOLOGY DIVISION REPORTS

319 in Canada, 40 in other countries of North America, 131 in South America, and 186 in other parts of the world. A total of 50 countries are represented. Today's membership in the United States stands for more than one-fifth the estimated geologic population of the country.

The rise in membership in the last 14 years has been impressive, but there is reason to believe that many geologists and scientists in related fields have not yet taken advantage of the opportunity to become Members, because they are unfamiliar with the requirements and procedure. There is evidence that many Members would like to become Fellows, but are equally, in doubt about their eligibility and the steps to take.

As an aid to possible candidates for Fellowship and their sponsors, the Society has prepared a General Information Circular, which gives details on eligibility, qualifications, and procedure for nomination and election. The circular is to be used in conjunction with the nomination and sponsors' evaluation forms, which have been redesigned for greater clarity and simplicity. The nomination form for Membership has also been recast and information for candidates and sponsors is given on a sheet accompanying the form. This material is available on request to the Society headquarters.

A brief summary of salient points on Membership and Fellowship taken from the detailed explanations, follows:

The minimum eligibility requirements

(Continued on page 46)

A question for the future, is the

Pendulum Swinging Too Far?

1960-61 Student Enrollment Survey[1]

Year	Colleges Queried	Colleges Responding	Total Geology-Geophysics Majors	No. in Geology	No. in Geophysics	Per Cent Undergrad.	Per Cent in MA Program	Per Cent in PhD Program
				UNITED STATES				
1961	236	236	7,691	7,147	544	58.7	23.2	18.1
Change in 1961	1.7%	1.7%	-15.4%	-16.2%	-3.9%	-5.9	1.9	4.0
1960	232	232	9,091	8,525	566	64.6	21.3	14.1
1959	226	226	10,407	9,828	579	69.2	20.6	10.2
1958	210	207	10,197	9,817	380	72.8	18.2	9.0
1957	207	204	9,439	9,145	294	73.0	18.2	8.8
1956	205	194	8,093	7,765	328	72.0	18.3	9.7
				CANADA*				
1961	18	18	840	747	93	65.5	23.5	11.0
Change in 1961	-	-	-4.3%	-5.0%	.1%	-4.0	2.9	1.1
1960	18	18	878	786	92	69.5	20.6	9.9
1959	18	18	823	739	84	72.8	17.5	9.7
1958	16	16	749	692	57	74.8	14.1	11.1
1957	16	16	594	560	34	72.9	16.8	10.3

*Not surveyed in 1956

Table 1. A summary of the 1961 enrollment of students of geology-geophysics in colleges and universities of the United States and Canada and a comparison of 1961 with the previous years 1956-1960.

This is the preliminary report on the survey of 1960-61 enrollment of geology-geophysics majors in undergraduate and graduate degree-granting departments in the United States and Canada. This survey has been conducted in the first quarter of the calendar year for the past five years. Department chairmen are the source of these data reported here. It should be recognized that these data will not tally perfectly with those published by the U. S. Office of Education, since its information is based on actual degrees granted, but the AGI survey results can be assembled and published promptly to show enrollment trends while the current academic year is still in progress.

In the 1961 survey the number of Canadian schools remained unchanged at 18, while there were four degree-granting departments added to the U. S. list bringing the number of geology-geophysics degree-granting institutions to 236. Despite difficulties in getting response from a few reluctant department chairmen, the second and third follow-up notices and some strategic phone calls resulted finally in 100 per cent coverage of all known geology-geophysics degree-granting academic institutions in the U. S. & Canada.

Tables 1 and 2 summarize the data collected on the junior-senior majors, and on graduate students in Master's and Ph.D.

[1] The data appearing in the tables and figures of this report were gathered and compiled by Mrs. Bonnie C. Henderson, Supervisor, Earth Sciences Register, American Geological Institute.

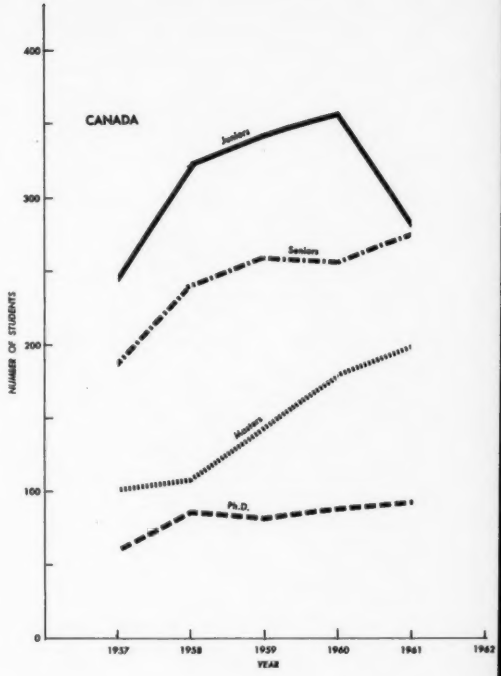


Figure 1. Graph showing trends in enrollment of geology-geophysics students at various academic levels in colleges and universities of Canada in the years 1957-1961.

programs in the 254 degree-granting institutions in the United States and Canada. As in the past detailed information reported by each school will be subsequently published in the 1961 Edition of AGI Report 12, *"Survey of Geology-Geophysics Students in Colleges and Universities of the United States and Canada."*

In Canadian schools a precipitous decline in the junior enrollment has been reported (Figure 1). It is significant to note that the junior enrollment in U. S. institutions began declining in 1957 and in 1959 reached a comparable rate of decline (Figure 2). The number of seniors in Canadian schools was somewhat larger than in 1960, but it seems probable that the senior enrollment will drop in 1962. The enrollment in the Ph.D. and Master's programs in the Canadian institutions continued on an upward trend. It will be important to observe the trend of the Master's programs in the coming year, for if it follows the U. S. trend, it is likely that the number of Master's students may be expected to decline next year.

In the United States, the sharp decline in enrollment of undergraduate geology-geophysics majors at the junior and senior levels continued unabated (Figure 2) and the enrollment in the Master's programs continued. The Ph.D. programs had a slightly increased enrollment. Figure 3 shows the percentage distribution of total U. S. enrollment of geology-geophysics students by each academic level for the six year period, 1956-61, of the AGI survey.

Going back to Figure 2—if we project into 1962 the enrollment trends of the past two years we come up with the very disturbing realization that the undergraduate majors being trained will equal enrollment in the Master's Program and will be but little larger than the enrollment in the Ph.D. programs. The undergraduates being trained and fed into graduate schools or directly into professional careers with no further graduate work will constitute only about 6 per cent of the total geology-

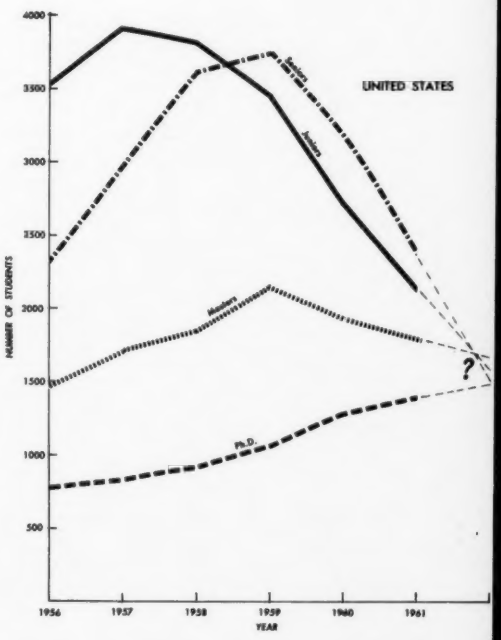


Figure 2. Graph showing trends in enrollment of geology-geophysics students at various academic levels in colleges and universities of the United States in the years 1956-61. The trends of 1960-61 are projected as a possible forecast for the 1962 enrollment picture.

		UNDERGRADS.		M.A.		PH. D.		Total
		Sr.	3d Yr.		Deg. Yr.	Int. Yr.	1st Yr.	
United States								
Geology	1961	2280	2028	1631	298	522	388	1208
	% Change	-24.9	-21.7	-8.7	10.4	1.0	19.4	8.6
	1960	3037	2589	1787	270	517	325	1112
	1959	3566	3329	1978	205	436	314	955
	1958	3511	3722	1760	198	379	247	824
	1957	2928	3819	1644	167	374	213	754
	1956	2269	3421	1391	150	305	229	684
Geophysics	1961	107	99	150	43	99	46	188
	% Change	-17.7	-13.9	-2.0	-	33.8	-9.8	11.9
	1960	130	115	153	43	74	51	168
	1959	173	134	163	25	65	19	109
	1958	92	103	94	23	42	26	91
	1957	54	86	76	23	49	6	78
	1956	58	84	87	20	52	27	99
Canada								
Geology	1961	256	249	169	30	21	22	73
	% Change	10.8	-23.1	.5	20.0	-8.7	-	4.3
	1960	231	324	161	25	23	22	70
	1959	227	316	131	29	19	17	65
	1958	231	291	95	30	21	24	75
	1957	182	232	91	17	20	18	55
Geophysics	1961	15	30	29	7	6	6	19
	% Change	-40.0	-	45.0	16.6	-16.6	50.0	11.8
	1960	25	30	20	6	7	4	17
	1959	31	25	13	7	4	4	15
	1958	10	28	11	3	2	3	8
	1957	5	14	9	2	3	1	6

Table 2. A summary of the 1961 enrollment of students of geology-geophysics at the various academic levels in colleges and universities of the United States and Canada and a comparison of 1961 with previous years 1956-1960.

geophysics professions (estimated at 25,000).

These enrollment trends, if they continue, raise a host of serious questions which should deeply concern all geologists and organizations employing geologists. Assuming that all currently graduating Ph.D's are employable and find employment and that there will be a slow but steady rise in future years in the demand for geology-geophysics Ph.D.'s matching the rise in population or our gross national product, *where will the undergraduate students come from to feed the graduate schools?* Will they come from the basic physical sciences, with no undergraduate training in geology? Will graduate schools find it necessary to lower their standards which they have been trying to raise in an effort to build up enrollment to meet demands for their graduates? Will industry, which for the past several years has been wielding the meat-axe on its exploration scientists, be back on the recruitment beat hiring sub-professional geologic talent out of the undergraduate class rooms, scrambling to outbid each other for warm bodies as in the Korean war days? Perhaps, there is no problem—could it be possible that ours is a rapidly shrinking profession which is destined to continue to shrink?

Whatever lies ahead it appears that unless the enrollment trends are changed the field of geology-solid earth geophysics and the people who employ geologists and solid earth geophysicists are in for trouble. How can departments with no students hold faculty members and compete for their share of college budgets necessary to maintain and advance their geology curriculum? How can top-notch students be attracted into undergradute study in the field in the face of such trends?

If on the other hand, the enrollment pendulum can be arrested in the present year and then swing slowly in the other direction, our position could be ideal. Most all undergraduate departments are reporting that all of their graduates are being strongly urged to continue study toward a higher degree. With the greater emphasis on graduate training the level of academic training of scientists entering the fields of geology-solid earth geophysics will rise fairly sharply and the over-all academic level of the profession will be raised. This trend is desirable for both the employer and employee; it would be unfortunate to have this healthy consolida-

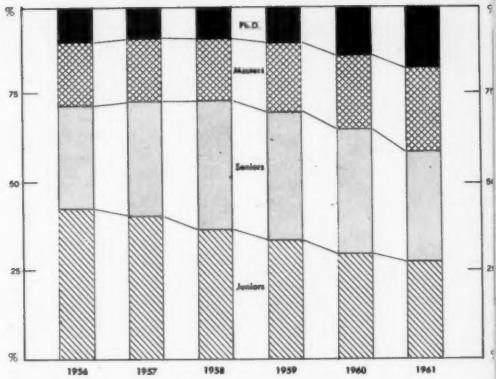
	Junior-Senior Majors and Graduate Students		Undergraduate Non-majors		Total Student Enrollment	
	1961	1960	1961	1960	1961	1960
			UNITED STATES			
Geology	7,147	8,525	62,532	52,683	69,679	61,208
Geophysics	544	566	301	363	845	929
Total U.S.	7,691	9,091	62,833	53,046	70,524	62,137
			CANADA			
Geology	747	786	4,324	3,974	5,071	4,760
Geophysics	93	92	72	68	165	160
Total Canada	840	878	4,396	4,042	5,236	4,920
TOTAL	8,531	9,969	67,229	57,088	75,760	67,057

Table 3. A summary of all students enrolled in courses in degree-granting departments of geology-geophysics in institutions of the United States and Canada in 1961 and a comparison with 1960.

EDUCATION LEVEL	SCHOOLS REPORTING ON EMPLOYMENT OUTLOOK					
	Better		About Same		Worse	
	1961	1960	1961	1960	1961	1960
Senior	24 (12.6%)	17 (9.4%)	128 (67.0%)	128 (70.8%)	39 (20.4%)	36 (19.8%)
M. A.	31 (28.2%)	34 (21.9%)	64 (58.2%)	109 (70.3%)	15 (13.6%)	12 (7.8%)
Ph.D.	21 (34.4%)	21 (35.6%)	33 (54.1%)	36 (61.0%)	7 (11.5%)	2 (3.4%)

Table 4. The opinions of responding department chairmen as to the 1961 employment outlook at the various academic degree levels as compared to one year ago, reported in per cent.

Figure 3. Percentage distribution of the total U. S. enrollment geology-geophysics students by academic level for the period 1956-1961.



tion of position of the profession upset by another scramble for bodies.

The job outlook facing the 1960 graduates is not likely to greatly affect the present enrollment trends. Department chairmen surveyed concerning 1961 enrollment were asked an optional question of a relative nature concerning the job outlook at the various degree levels. Table 4 summarizes the subjective estimates made by those heads of departments responding to this question.

Information on starting salaries was also sought at the option of the respondents and about one-third replied. The median starting salary for persons with only a bachelor's degree is indicated to be $445 per month, the same as in 1959 and 1960; with a Master's degree $540 per month. The median starting salary for the Ph.D. is about $8000—about $125 per month higher than for persons with only the Master's. Special conditions cause a wide range in salaries particularly at the Ph.D. level. At all levels, foreign employment carries a salary bonus.

Although departments are not as busy training majors, there are more non-majors taking geology in 1961 than last year. The degree granting departments of the U. S. and Canada reported a total of 67,229 non-majors in 1961 as compared to 57,088 in 1960. No effort was made to survey the non-majors in the more than 200 institutions offering geology courses but not granting degrees.

SEISMOLOGICAL SOCIETY ELECTS NEW OFFICERS

At a recent meeting of the Seismological Society of America, the following persons took office:

President: Dean S. Carder

First Vice President: Frank Press

Second Vice President: Benjamin Howell, Jr.

Third Vice President: Don Tocher

Secretary: Karl V. Steinbrugge

Treasurer: William K. Cloud

Directors of the Seismological Society are: Hugo Benioff, Perry Byerly, Dean S. Carder, William K. Cloud, John H. Hodgson, Benjamin F. Howell, Jr., Jack Oliver, Frank Press, Charles F. Richter, Karl V. Steinbrugge, Don Tocher, and M. A. Tuve.

Visual Education Aid Needed

An immediate objective of the AGI Visual Education Committee is to prepare a list of about 50 films on the geological sciences suitable for use by secondary school science teachers. It is anticipated that this list will be prepared and listed on or before July 1 in order that it can be distributed to the many science teachers enrolled in NSF sponsored summer institutes.

Help is needed

Individuals are invited to submit reviews of films on geology and related sciences which in their opinion should be included in this teaching aid list.

The film reviews should include the following:

1. **Title,** date of issue.
2. **Description:** Size? Sound? Color? Length?
3. **Brief annotation** (100-150 words) describing film subject matter, strong points, weak points.
4. **Age level suitability:** Elementary, secondary, college, general public.
5. **Producer:**
6. **Sponsor:**
7. **Availability:** Loan, rental, purchase (cost if known).

If your review is published, you will be given a credit line. Send your reviews to:

William R. Muehlberger, Chairman
AGI Visual Education Committee
Department of Geology
University of Texas
Austin, Texas

MANPOWER *in a column —*

By HOWARD A. MEYERHOFF
Scientific Manpower Commission
1507 M Street, N.W., Washington 5, D. C.

The Denver meetings of the AAPG and SEPM prompt some sober reflections on the value the oil industry seems to attach to the specialists it sought so avidly five years ago, when it was looking for new production and reserves at home and abroad.

What these earth scientists accomplished for the domestic industry alone has been disclosed in a special survey conducted by the American Petroleum Institute, the Independent Petroleum Association of America, and the Mid-Continent Oil and Gas Association. In 1959, $2.65 billion were spent in drilling and completing 49,563 oil and gas wells. Domestic reserves and potential production were both increased. Less precise figures for 1960 are of the same order of magnitude.

The lag between exploratory research and the production for which this research can take credit has been a disservice to the profession in three ways: First, the applications of the research have had cumulative effects on production that have made geologists and geophysicists expendable.

Second, the lag has given the nationals of other countries, trained when American personnel was scarce, an opportunity to gain experience and thus limit foreign employment possibilities.

Third, cutbacks in field activities and reductions in staffs have provided time and opportunity for the reporting of research, as the AAPG-SEPM programs at Denver demonstrate. The dissemination of these research findings is bringing company files up to date on every front and is thus minimizing the need for independent investigations in all but the most progressive organizations.

In short, a large segment of the industry is getting a free ride, which will soon dead-end, unless industry recognizes both its obligations and long-range needs.

Seasoned earth scientists are leaving the profession with information that has never been recorded. At least one society reports the smallest annual net gain in membership since the depression of the thirties. It is operating at a loss and dares not raise dues under present adverse conditions. Will it cut publication to survive?

Curtailed exploration, reductions in force, and financially weak societies all point in one direction. The oil industry may feel sorry for itself now, but could it be heading for second-rate status in the world's booming petroleum competition?

Committee of 1000 for AGI 1961

reaches membership of 850

Geological scientists are interested in the American Geological Institute. As of April 1, 1961 there were 850 geologists who were sufficiently interested in the AGI to contribute $10 to aid in the support of the Institute's program.

The investment by these members of the Committee of 1000 for AGI-1961 could be cited as sound, for based on performance over the past several years, AGI could be expected to parlay each of these dollars received from the profession itself with about 9 dollars from other sources to carry out its program for the advancement of geology and the welfare of geological scientists.

You can add your name to this list of AGI supporters by joining the Committee of 1000 for AGI-1961 through a contribution of $10 or more. If you cannot join this group, you still may wish to be one of those persons who have contributed a lesser amount to advance the work of AGI.

Kilauea Eruption Probable

The U.S.G.S. Hawaiian Volcano Observatory has reported that there are growing indications of another eruption of Kilauea volcano in the same general area as the major flank eruptions of 1955 and 1960.

Since January 1961, the Survey has recorded numerous shallow earthquakes comparable to those which preceded the 1955 and 1960 eruptions. The interval between the *P* and *S* wave arrivals indicates an epicenter not more than two miles beneath the surface. The ground of the area is bulging upward at a rate about 10 times the upswelling rate preceding the 1955 and 1960 eruptions.

Residents and civil authorities will be informed promptly of any significant new developments.

Committee of 1000 members added since March 10, 1961

Earl O. Abbott
Elmo W. Adams
Joseph L. Adler
C. G. Allen
Jerald Alliger
Philip R. Allin
David L. Amsbury
G. C. Amstutz
Eskil Anderson
J. Q. Anderson
Milton Anderson
Maurice E. Arnold, Jr.
James S. Bailey
Roger C. Baker
Christina L. Balk
Samuel B. Ballen
J. L. Barefield
T. R. Barnes
William K. Barry
G. W. Beer
A. Lyndon Bell
P. C. Benedict
Alan M. Bieber
Eliot Blackwelder
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Bruce E. Brown
John S. Brown
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L. G. Byerley, Jr.
Loren T. Caldwell
C. D. Campbell
James W. Caylor
S. E. Cebull
Jesse M. Chipman, III
Charles E. Clarke
Richard J. Claus
Lewis M. Cline
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R. V. Colligan
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J. N. Conley
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Paul E. Damon
D. A. Davis
Robert E. Davis
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J. F. de Chadenedes
L. C. Decius
Henry J. Degenkolb
Wallace de Laguna
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Jack M. DeLong
George R. Ditsworth
Kent C. Dixon
Edward C. Doell
Philip Donnerstag
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James H. Drewelow
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Charles G. Evensen
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G. F. Worts, Jr.
Robert J. Wright
John T. C. Yen
Robert S. Young

Listed here are 242 members of the Committee of 1000 for AGI-1961. Previous lists have been published in the March and April issues of *GeoTimes*.

Maurice Ewing (second from left), geologist and oceanographer, became the first earth scientist to receive the Dickinson College Award in Memory of Joseph Priestley on March 23 when it was presented for the tenth time. He was honored for "distinguished contributions to mankind through geophysics." The annual award, a portrait medallion of Priestley and $1000, was established in 1952 to recognize achievement in the natural sciences. In the photo, l. to r., Dr. Winthrop C. Difford, head of the geology department at Dickinson; Dr. Ewing; Gilbert Malcolm, president of the college, and Dean Roger E. Nelson. Dr. Ewing spoke on the subject "Free Vibrations of the Earth."

Geological Society of Sacramento

The Geological Society of Sacramento will hold its annual Spring field trip on the weekend of May 27 and 28, 1961. The trip will cover the geology along part of the east side of the Sacramento Valley, California, from the Oroville Damsite area to Chico Creek and the Marysville Buttes. Guidebooks will be prepared. Accommodations and a banquet for Saturday evening, May 27, are being arranged for the group at Richardson Springs, north of Chico. For information concerning this field trip and also about previous excursion guidebooks contact the *Geological Society of Sacramento, c/o Gulf Oil Co., P. O. Box 4195, Sacramento 21, California.*

Canadian Mineralogist

The University of Toronto, Geological Series, *Contributions to Canadian Mineralogy*, consisting of 26 issues with indexes, is available at less than one-third the cost of a complete set in book form from the *Walker Mineralogical Club, 100 Queen's Park, Toronto 5, Canada.*

GEOLOGY in the Public Eye

by
Robert L. Bates
Department of Geology, Ohio State University

Once there was a science that considered itself underrated in the public mind and out of focus in the public eye. This was especially intolerable because at that time the demand for practitioners of the science was at an all-time high. The members of the profession, being men of discernment and drive, undertook to meet the problem. In six years (which oddly enough is how long this column has been keeping unofficial track), a massive publicity effort was directed toward school children, teachers, Boy Scouts, and the general public. Schools were lectured to, career booklets issued, and prizes awarded; TV was utilized for one-shot programs, open-end programs, and closed-circuit programs. Teachers were provided with summer institutes, and were taken on field trips till they were footsore. Liaison with the hordes of rockhounds was strengthened throughout the land. . . . But all this was as nothing compared to the torrent of printed matter that appeared. Twenty-two State surveys issued more than 40 publications for the layman. These included guides to highways, mineral localities, parks, and just plain scenery. Would-be paleontologists were inundated with booklets on fossils. The Federal survey issued a pamphlet that explained all about water. No sooner did an earthquake occur than an explanation appeared for the tourist. Beryllium was given the nod by the *Wall Street Journal*, geochemistry by *Fortune*, and Charles Darwin by (appropriately) *Life*. Words by J. W. Vanderwilt graced a life-insurance ad, P. M. Hurley made the *Satevepost*, and R. H. Jahns got mentioned in *Sports Illustrated*. It got so that kiddies couldn't pick up their classroom magazines without finding two or three articles by eminent authorities on geochronology or the origin of the earth. . . . A time finally came when the public was informed up to its ears, the name of the science was a household word, and young people by the hundreds were deciding to make this subject their life work. And what happened? Unfortunately, in the meantime the roof had fallen in. There weren't any jobs in this widely trumpeted field.

Moral: *A public-relations effort pays, but not when a science is out of phase.*

GEOTIMES

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Field Check List for Soils

A suggested field check list for examination and description of soils adapted by Sidney White from the U. S. Department of Agriculture Handbook No. 18, Soil Survey Manual.

SOIL TYPE: Name, as Miami silt loam

CLASSIFICATION: Great Soil Group, as Gray Brown Podzolic

NATIVE VEGETATION: as oak and hickory

CLIMATE: as humid temperate

PARENT MATERIAL: as calcareous clayey till

PHYSIOGRAPHY: as till plain, or high terrace

RELIEF: Varying degrees of level and nearly level, undulating, rolling, steeply sloping, or hilly

SLOPE: Approx. gradient or percent slope

DRAINAGE: Varying degrees of poorly, moderately, well, or excessively drained

GROUND WATER: Give depth (if can) or just "deep"

PERMEABILITY: Varying degrees of slow, moderate, or rapid

MOISTURE: Present soil moisture, as wet, moist, moderately dry, or dry

SALT OR ALKALI: Concentration of either or both (if can), as slight, moderate, or strong

STONINESS: Varying degrees of, as no stones, or in feet apart, 30-100, 5-30, 2.5-5, and <2.5

ROOT DISTRIBUTION: Depth of penetration as "deep" or to a certain depth or horizon; and abundance, as few, plentiful, or abundant

REMARKS: Additional detail on above items, or additional items, as organic matter content, evidence of worms, insects, rodents (krotovinas), special mottling, or stone lines

HORIZON:

- A_{00} - loose leaves and organic debris (undecomposed)
- A_0 - organic debris partially decomposed and matted
- A_1 - dark-colored, high content of organic matter mixed with mineral matter
- A_2 - light-colored, maximum eluviation
- A_3 - transitional to B, but more like A than B, sometimes absent
- B_1 - transitional to B, but more like B than A, sometimes absent
- B_2 - maximum accumulation of silicate clay minerals or of iron and organic matter; maximum development or blocky or prismatic structure; or both. In pedocals this layer has maximum $CaCO_3$, $CaSO_4$, etc.
- B_3 - transition to C (often absent)
- C - weathered parent material; may contain accumulated $CaCO_3$ layer (Cca) or $CaSO_4$ (Ccs) C horizon occasionally absent
- D - unweathered parent material

Additional copies of this data sheet may be obtained from the AMERICAN GEOLOGICAL INSTITUTE, Cost $0.10.

DATA SHEET 25

AGI Data Sheet 25, *Field Check List For Examination and Description of Soils* was adapted for the AGI Data Sheet Series by Sydney White from the U.S. Department of Agriculture Handbook No. 18, *Soil Survey Manual.*

A complete list of all AGI Data Sheets may be obtained by requesting the AGI List of Publications. Write: *Publications, American Geological Institute, 2101 Constitution Ave., N.W., Washington 25, D.C.*

The AGI Data Sheet Committee consists of the following members: *John E. Allen, William Beatty, Chester Longwell, George Thompson, Ian Campbell, Bob Wallace,* and *Richard M. Foose,* Chairman.

Suggestions for additional data sheets are welcomed by the Data Sheet Committee and should be forwarded to *Dr. Richard M. Foose, Earth Sciences Division, Stanford Research Institute, Menlo Park, California.*

DEPTH: Inches or centimeters from top of A_1

THICKNESS: average, as 6; and range, as 4-8

BOUNDARY: always lower horizon boundary, as to distinctness: abrupt - a, clear - c, gradual - g, diffuse - d; and as to topography: smooth - s, wavy - w, irregular - i, broken - b

COLOR: Record both wet and dry soil colors, always by appropriate notation from Munsell Soil Color Charts (Munsell Color Co., Baltimore 2, Md.) as 10YR 5/4. Soil color names may be written later (e.g., Chart 10YR for 5/4 is yellowish brown).

TEXTURE: Particle size, varying grades of gravel, sand, silt, clay:
sand - s (80% or more sand, 20% or less silt or clay);
sandy loam - sl (75% ± sand, 14% ± silt, 11% ± clay);
loam - l (40% ± sand, 42% ± silt, 18% ± clay);
silt loam - sil (5% sand, 82% ± silt, 13% ± clay);
clay loam - cl (33% ± sand, 42% ± silt, 25% ± clay); and
clay - c (10% ± sand, 45% ± silt, 45% ± clay)

STRUCTURE: Description of the individual natural soil aggregate (or ped), includes, size: very fine - vf, fine - f, medium - m, coarse - c, very coarse - vc; grade: structureless - 0, weak - 1, moderate - 2, strong - 3; and form: platy - pl, prismatic - pr, blocky - bk, granular - gr, single grain - sg, massive - m.

CONSISTENCE: Degree and kind of cohesion and adhesion and resistance to deformation or rupture; in wet soil: nonsticky - wso, slightly sticky - wss, sticky - ws, very sticky - wvs, nonplastic - wpo, slightly plastic - wps, plastic - wp, very plastic - wvp; in moist soil: loose - ml, very friable - mvfr, friable - mfr, firm - mfi, very firm - mvfi, extremely firm - mxfi; in dry soil: loose - dl, soft - ds, slightly hard - dsh, hard - dh, very hard - dvh, extremely hard - deh; cementation: weakly cemented - cw, strongly cemented - cs, indurated - ci.

REACTION: Intensity of soil acidity or alkalinity, use field pH meter, express in pH figures; also record effervescence with 10% HCl, as slight - e, strong - es, violent - ev.

SPECIAL FEATURES: as lime, iron, or siliceous concretions; buried soil horizons; unusual accumulation of loess; $CaCO_3$ accumulation or caliche (Cca); $CaSO_4$ accumulation (Cs); iron, manganese, or phosphate accumulations; frozen soil or permafrost (f); indurated horizons (m), mainly of silicate minerals (a fragipan); disturbance by plowing (p), or by burning of A_0; thin clay layers within a horizon (t); unconformable layers (u), such as stone lines; fillings of rodent burrows (krotovinas - k).

MEMBER SOCIETIES
of the
AMERICAN GEOLOGICAL INSTITUTE
June 1960 Edition

A 16 page booklet which gives data on the organizations, history, purpose, membership requirements, publications, and other pertinent information on the fourteen Member Societies of the American Geological Institute.

Lists present officers of all Societies.

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AGI LIST OF PUBLICATIONS

AGI has recently published a new list of publications, listing the various journals and other publications published by AGI.

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AMERICAN GEOLOGICAL INSTITUTE
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Washington 25, D. C.

American U. Sponsors Appalachian Institute

The Department of Geology of American University, Washington, D. C., will conduct a summer conference for college geology teachers on the stratigraphy and structure of the Appalachians. The program is supported by a grant of $19,200 from the National Science Foundation and the director is Matthew F. Norton.

Dallas Society Makes Grant

The Department of Geology of Southern Methodist University has been awarded a $750 research grant by the Dallas Geological Society. This grant is made in support of a M.S. thesis research study being understaken by Robert L. Laury, a graduate student in the department. The project, which is being done under the direction of Drs. Dan E. Feray and James E. Brooks, will consist of a detailed study of the stratigraphy of the Canyon Series in its type area near Strawn, Texas.

GEOLOGY in POLAND

by JOHN P. MILLER[1]

During June and early July, 1960, I spent thirty days in Poland at the invitation of the Institute of Geography, Polish Academy of Sciences. The purpose of my visit was to give a series of lectures on various aspects of my specialty (geomorphology) at geographical, geological and soil science centers. The trip was made possible by a grant from the National Science Foundation covering round trip air fare. My wife, who was invited also, traveled at her own expense, but while in Poland both of us were guests of the Institute of Geography.

Our tour included a few days at each of the Polish universities (located in Warsaw, Krakow, Wroclaw, Lodz, Lublin, Poznan, and Torun) and the Institute of Soil Science at Pulawy. In addition to the visits at universities and brief sight-seeing trips in various cities, there were also special excursions arranged for the purpose of seeing in the field many phases of current research in geography, geology and soil science. Our total travel amounted to roughly 5,000 kilometers, and was mostly by automobile (see fig. 1, showing location of university cities and routes traveled).

Everywhere in Poland we were cordially received. There appeared to be much interest in the lectures, and each one was followed by long and vigorous discussions. The Poles are excellent linguists; many scientists speak several foreign languages including English. They are generally aware of current scientific work in the United States, but because of the dollar shortage, their library holdings of American journals and books are exceedingly restricted.

My general impression is that Polish geology, at least in the fields I know best, is carrying on in the tradition of excellence for which it has long been noted. Although there is some direction from the State, research at present is hampered far more by lack of equipment, libraries, and other facilities, destroyed during the war, than by restrictions on individual freedom. Yet, despite these obstacles important fundamental work is being done, and a well-trained corps of young scientists is developing.

The organization of geology in Poland is similar to that elsewhere in Europe,

Figure 1. Route maps of the Millers' travel in Poland.

[1] JOHN P. MILLER, Department of Geology, Harvard University.

which in turn is somewhat different from the present condition in the United States. Geology refers almost exclusively to bedrock geology, with strong emphasis on petrology, stratigraphy, and paleontology. My own specialty, geomorphology, and Pleistocene studies, are carried on mostly in the field of geography.

Geology departments are located in the University of Warsaw, Jagellonian University in Krakow and Wroclaw University. Other universities give limited instruction in geology as a part of the curriculum in physical geography. The present condition of buildings housing geology departments in the various universities depends very largely on the extent of destruction during the war. Where damage was severe, as in Warsaw, everything is new. However, in all the universities, library facilities and equipment are in short supply.

University training in geology does not appear to be radically different from current practices elsewhere in the world. In general, advanced graduate students do less formal course work and more independent study than in the United States. Only a small fraction obtain Ph.D. degrees. This is because the time required is very long, and also the demand for personnel with the Ph.D. is not great. Admission to universities is determined by examination; expenses of students at all levels of training are covered by direct State subsidies.

Geological Institute

The principal geological organization of the country is the Geological Institute, located in Warsaw. It serves essentially the same functions as our U. S. Geological Survey except for the fact that water resources (and meteorology) are organized under another institute. The Institute was first organized in 1919, after the recovery of Polish independence, and was reorganized in 1938, and again in 1953. Like everything else in Warsaw, it was heavily damaged during the war, with buildings, libraries, collections, and equipment destroyed, and many key personnel killed.

The tasks of the Geological Institute as established by the statute organizing it, are twofold: (1), research in all the fundamental geological sciences, especially stratigraphy, dynamic geology, tectonics, sedimentology, petrography, and geochemistry. The major ultimate objective is to work out a synthesis of the geological structure of Poland, bringing together the results of all available techniques, but relying heavily on geophysical investigations initiated since the war. (2) Study and extension of the national raw material base constitutes a separate branch that includes geology of industrial materials, hydrogeology and engineering geology.

The annual budget of the Geological Institute at present is about 200,000,000 zlotys (about $8,000,000) a year. Of the 800 employees, 26 are called "independent scientific workers," the rest being auxiliary workers of various kinds, with more than 95% below 40 years of age.

The Institute has a very large and well-organized museum, which has been completely reestablished since the war. Such equipment as microscopes and routine chemical apparatus is available in sufficient amounts. However, apparatus for special research, especially in many phases of geochemistry and some aspects of geophysics, is not obtainable at present. There is much interest in age determination work, especially the various methods for dating ancient rocks, but it has not been possible to obtain the necessary equipment. A radiocarbon laboratory began operation late in 1960.

In recent years, the activities of the Geological Institute have been concentrated heavily on exploration of buried bedrock structures. Nearly all of Poland is covered by a thick mantle of glacial drift (see fig. 2). In order to determine the nature of the bedrock, there has been extensive geophysical work (gravity, magnetic) and also a very large number of borings, including several which extend to depths of more than three thousand meters. Naturally, it was hoped that these investigations would lead to discovery of economic minerals, and also petroleum. In a few cases, they have been successful, but for the most part, the country's mineral base continues to be centered in south Poland, especially in Silesia. Thus far, results of exploration for petroleum have not been encouraging.

Numerous Publications

Work done since the war has led to numerous important publications in the field of regional geology and tectonics. Maps of several kinds have been published as the Geological Atlas of Poland (sixteen sheets) on a scale of 1:1,000,000. In addition, a detailed map on a scale of 1:50,000 was begun in 1956. A series of hydrogeologic and engineering geology maps on a scale of 1:300,000, and also several others, have been published recently.

There is a very large literature on Polish geology, and much of it is recent. Numerous journals are currently being published. Also, there are several publication

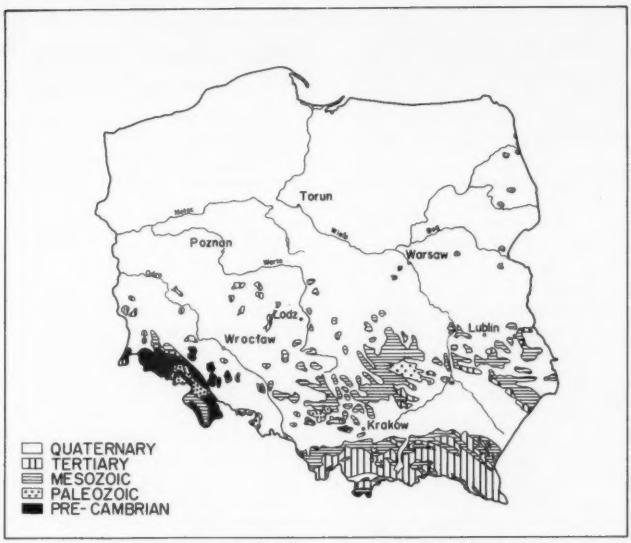

Figure 2. Generalized geologic map of Poland.

series of the Geological Institute. Nearly every paper is accompanied by an extended English summary, and the diagrams in most cases have English captions, thus making this literature more available than ever before to non-readers of Polish.

Doing geological field work in Poland is not easy. Probably the biggest difficulty, as viewed through American eyes, is the shortage of transportation. Practically no-one owns a car. Even motorcycles and bicycles are expensive, and in short supply. This means that field investigations require a trip by train to the area, and subsequent movement through the country is entirely on foot, or less commonly, by bicycle. Military restrictions prohibit almost completely the use of aerial photographs for scientific purposes. Detailed topographic maps are available, however. In order to publish a report of an area, it is necessary for the author to generalize his original detailed geologic map so as to not violate security requirements.

In the course of our visit, numerous excursions gave us opportunities to see much geology in the field, including the crystalline sequences of the Carpathian and Sudeten Mountains, the flych sediments at the foot of the Carpathians, the strongly folded Paleozoic rocks of the Swietokrzyskie (Saint Cross) Mountains, and especially the Pleistocene sequence which includes many of the classical localities of Europe. An impressive feature of the Polish Pleistocene is that the glacial landforms are readily visible because so much of the land has been cleared for agriculture.

There is at present a surplus of geologists in Poland, but this has nothing to do with the oil or mining industry. Rather, plans made several years ago overestimated the needs that actually developed for geological personnel. This same overplanning is reflected in the new geology building at the University of Warsaw, where the space available greatly exceeds the amount needed, at least for the present.

INQUA Meeting

Finally, it may be well to comment briefly on existing conditions in Poland for the benefit of geologists planning to attend the INQUA (International Association on Quaternary Research) meetings in the fall of 1961.[2] Anyone making his first visit to Poland should expect to find conditions different in many respects from those prevailing in the United States. Almost everything is State owned and operated, with the result that service in restaurants, hotels, stores, etc. is slow and indifferent. Poland has some excellent highways, but as most Poles cannot afford cars, facilities for motoring are scarce and undependable. Except for less variety Polish food is generally similar to ours and the daily schedule of meals is only slightly different. Hotel accommodations are satisfactory only in the larger cities. Polish

[2] Technical sessions will be held in Warsaw September 2-7, with pre-Congress excursions August 29-31 and a post-Congress excursion September 9-20

plumbing is a disgrace and drinking water is unsafe in many places. If the several hundred scientists who are registered actually attend the INQUA meetings, facilities for accommodations will be greatly strained.

On the other side of the coin, Americans may be assured of an exceedingly warm and friendly welcome from the Poles—not just the scientists, but all the Poles they meet. They are intensely interested in America, and are full of questions about it. Likewise, they are exceedingly knowledgeable on all matters of history, and delight in showing the visitor the ancient buildings and monuments of their area. Actually, many are reconstructions rebuilt in the old style, and each as nearly as possible as it was at the time of its greatest glory. Most Poles are very enthusiastic about the restoration program, and seem not to mind too much that they must go on short rations and live in crowded quarters until this objective is achieved. Likewise, they are very devoted to the arts, especially music, and every town has a community center where concerts, operas, and other activities are held regularly. Following the war, the opera houses and the music halls were among the first things to be rebuilt. The excellence of Polish musicians is well known in America. Although there are some restrictions on one's movements in Poland, and such annoyances as registration with the police in every town, the genuine friendly nature and amazing hospitality of the Poles will offset any such inconveniences, and will make a visit to Poland during the INQUA meetings a truly memorable occasion.

New Australian Science Magazine

A new monthly journal on scientific research, development and application, *The Australian Scientist*, began publication with vol. 1, no. 1, February 1961. The journal can best be compared to the Scientific American among U. S. scientific journals. The initial issue contains articles to meet a wide range of interests. The journal appears to have strong support of Australian scientists as evidenced by the list of authors. Overseas subscription rates: 1 year —£ Sterling 4/5/0; 3 years—£ Sterling 11/5/0. Address subscriptions to publishers *Tasman Productions, 9-23 Upward St., Leichardt, Sydney, N.S.W., Australia.*

Coastal and Shallow Water Science Conference

The National Science Foundation and the Biology and Geography Branches of the Office of Naval Research are jointly sponsoring a conference on Shallow Water and Coastal Research to be convened in late October, 1961. Separate meetings will be held on each coast during this period. All scientists of all disciplines currently working in coastal or shallow water studies will be encouraged to attend and to submit brief summaries of their work. These summaries together with a tabulation of the numbers of persons and organizations involved in this interesting physical area will be published in a proceedings volume following the meetings. A limited amount of expense money will be available to help defray the cost of travel to the meeting places, particularly for academic representatives. Members of interested state and federal agencies will also be invited to attend the short one or two day sessions. The centers for each coast are the Chesapeake Bay Institute of Johns Hopkins University (Atlantic), the Oceanographic Institute of Florida State University (Gulf) and the Allan Hancock Foundation of the University of Southern California (Pacific). Additional information may be obtained from the *General Chairman, Dr. Donn S. Gorsline of the Oceanographic Institute at Florida State University, Tallahassee, Fla.*

Electron Microscopy Course

A two-week course in electron microscopy for research workers in the physical sciences will be given by the staff of the Electron Microscopy Laboratory of The College of Mineral Industries, The Pennsylvania State University, University Park, Pennsylvania, September 3 through 15, 1961.

The program will consist of lectures by the staff and personnel from industrial and government research laboratories. Topics covered will include basic theory of electron optics, instrumentation, electron diffraction, specimen preparation techniques, applications and other subjects determined by the interests of the participants. Laboratory facilities are available for practical experience in techniques. Instruction will be given on both the RCA EMU-2D and Hitachi HU-11 microscopes.

Further information can be obtained from *Professor Joseph J. Comer, College of Mineral Industries, The Pennsylvania State University, University Park, Pennsylvania.*

Symposium on Postmagnetic Ore Deposition

Praha, Czechoslovakia 1963

In 1963 a symposium entitled *"Problems of the origin of postmagmatic ore deposition (with special reference to the geochemistry of ore veins)"* will be held in Praha, Czechoslovakia. The purpose of this symposium is to discuss some of the important questions concerning postmagmatic ore deposition.

The following questions have been selected for discussion:

1. Problems concerning the origin of primary zoning in ore veins, ore deposits and larger units. Discussion on the following questions will be especially welcomed:
   a) Criteria proving polyascendent[1] (pulsation) zoning. Causes of the polyascendent origin of hydrothermal deposits.
   b) Criteria proving monoascendent origin and monoascendent zoning.[1] Criteria proving that different minerals in ore veins were deposited from the same solution, or from the uninterruptedly ascending solution.
   c) Evolution of chemical composition of ore bearing solutions dependent on the same source.
   d) Other contributions on questions of zoning.
2. Criteria solving the manner of the transport of metals in ore bearing solutions and comments on the existing views.
3. Reasons for or against the distinguishing of the pneumatolytical phase in the classification of postmagmatic processes.
4. Criteria for the recognition of metacrysts of minerals.
5. Role of selective replacement in hypogene ore deposition.

Contributions in one of the Congress languages dealing separately with the individual questions each of which not exceeding five typewritten pages are welcomed. The number of figures or plates should not exceed two pages. Manuscripts ready for print should reach the General Secretary of the Symposium. M. STEMPROK (Geological Survey of Czechoslovakia, Malostránské nám. 19, Praha 1, Czechoslovakia) before December 15th, 1961.

The contributions received will be published as a separate volume available several months before the symposium takes place. Further information on the symposium may be obtained from J. Kutina, Faculty of Natural Sciences, Charles University, Praha; M. Vanecek, Geological Survey of Czechoslovakia, Praha, contributors of this announcement.

[1] *See:* Econ. Geology, vol. 52, pp. 316-319, 1957.

WANTED: More Volunteer Abstracters

In 1960, GeoScience Abstracts had 3600 entries, nearly 400 more than its first year. These abstracts covered material primarily from 425 serial publications.

An essential ingredient in providing the best abstracts is the participation of professional geologists in screening the literature and providing concise abstracts where needed. Right now there are nearly 75 geologists who systematically review literally hundreds of journals for GeoScience Abstracts. You can check who they are by noting the credit line after each abstract in GeoScience Abstracts. Two groups have organized volunteers to provide abstracts coverage of specific fields of interest. Ed Eckel (U.S.G.S., Denver) heads a committee of engineering geologists and John J. Stephens (Ohio State University) a similar group of vertebrate paleontologists.

More volunteers are needed. Currently overworked volunteers would appreciate relief, sources previously overlooked must be systematically checked, and new journals are appearing regularly. Immediately, volunteers are needed from readers of the Bulletin of the AAPG; Izvestiya of the Academy of Sciences of the U.S.S.R., Geologic Series (AGI's translation of the Soviet journal); Journal of Petroleum Technology; Boletin de la Sociedad Geologica Mexicana; Boletin de la Asociacion Mexicana de Geologos Petroleros; Oil and Gas Journal; and World Oil.

If you can offer assistance toward providing abstracts coverage of any of these fields, you are urged to write to *Martin Russell, Managing Editor, GeoScience Abstracts, American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D. C.*

Popular Geology in print

by Mark W. Pangborn, Jr.

In MAP MAKING: THE ART THAT BECAME A SCIENCE (Little, Brown, 1960, $4.75) expert *Lloyd Arnold Brown* traces the development of maps and mapping techniques from ancient times to the present. This volume lies between the author's detailed "The Story of Maps" and Erwin Raisz's easy "Mapping the World," and its relaxed and readable style will appeal to both teenagers and uninitiated adults; adequate illustrations but no bibliography.

Youngsters 10 to 14 will enjoy THE STORY OF MAPS AND MAP-MAKING, by James A. Hathway (Golden Press, 1960, $.69), and informative and lavishly illustrated primer on making and reading maps. Among topics treated are latitude and longitude, projections and the earth's shape, orientation and the compass, the representation of relief, and the activities of the U.S.G.S. and the Coast Survey; the little book ends with a discussion of various special kinds of maps and their uses, in which, alas, the geological "map" turns out to be a cross section; no bibliography.

Two more fine children's books are paleontologist *Edwin H. Colbert's* THE WORLD OF DINOSAURS (Home Library Press, 1961, $2.50), a concise, meaty, and very well illustrated history of the dinosaurs, suitable for ages 8 to 14, and SIXTY MILLION YEARS OF HORSES, by *Lois* and *Louis Darling* (Morrow, 1960, $2.50), intended for ages 8 to 12; perhaps half of the latter deals with the geologic history of the horse and the remainder with its development in historic times; numerous fine illustrations.

In PREHISTORIC MAN (Tudor Publishing Co., 1960, $9.95), Czech paleontologist *Josef Augusta* and painter *Zdenek Burian* have turned out a fitting companion volume to their "Prehistoric Animals" of 1958. This truly magnificent picture book features 26 restorations in color, 16 others in black and white, and 10 plates of artifacts, and traces man's history from the Australopithecinae to the beginning of the Neolithic; the accompanying text, a little ponderous in style, is suitable for ages 12 up.

We are glad to see that *Winifred Goldring's* HANDBOOK OF PALEONTOLOGY FOR BEGINNERS AND AMATEURS, PART 1, THE FOSSILS—N.Y. State Museum Handbook 9—is in print once again (Paleontological Research Institution, 109 Dearborn Place, Ithaca, N.Y., 1960, $3). Sixty five pages explain the nature of fossils and tell how to collect and prepare them; the remaining 300 pages systematically describe the animal and plant kingdoms, emphasizing fossil forms. Illustrations barely adequate; good bibliography. Not in a class with the Fenton's "Fossil Book," but a bargain at $3.

Subsurface Sand Prediction Method Patented

Two related patents of considerable importance in exploration for petroleum were issued recently to Shell scientists. The described inventions reflect the intimate teamwork between scientists of diverse backgrounds participating in Shell's broad program of research at its Houston Exploration and Production Research Laboratory. Dr. R. H. Nanz, geologist, has invented a new method for predicting the geographic trend of sands in the subsurface by determining the geographic direction of predominant alignment of the grains by physical measurements either on a core sample or in a well penetrating the sand (U. S. Patent No. 2,963,641). Implementing the method, Mr. J. L. Arbogast and Drs. C. H. Fay and S. Kaufman, physicists, have invented an instrument which rapidly and accurately determines this alignment by measuring the dielectric anisotropy of an appropriately selected and treated core sample (U.S. Patent No. 2,963,642). This knowledge adds another to the oil-finding techniques being used by Shell men who must decide where to drill wells.

Shell is pleased to announce that universities and colleges may make free use of these patented techniques for purposes of academic research, but not for commercial purposes.

Mr. Arbogast and Dr. Kaufman are physicists at the Shell Development Laboratory in Houston. Dr. Fay is presently in New York as Technical Assistant to the President of Shell Development Company, and Dr. Nanz is Director of Exploration Research at the Houston Laboratory.

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ROCK CHIPS

by SANDSTONE SAM

SAM'S NOTE: The success of the Guadalupe tests should not lead to over-optimism. GeoTimes turns the clock ahead with the above letter which was received recently (from Midland, Texas of all places) with the bottle (California wine) and its enclosed, partially charred message (Progress Report, USA Mohole No. 1) which is reproduced as received from Mike Maestrichtian.

DEAR SAM:

Pete he and me walk beech. Long time. This time found bottle no wood or shell. In side is writing. Pete say it Rushian note C he bulgaria but no I don't beleeve. Grocery store man say it govment boondog. Gas station man say it four atomic sub base. Drug store man (he college) say very important to somebody somewhere maybe. I send to you.

Please send bottle back.

MIKE MAESTRICHTIAN

PROGRESS REPORT

U.S.A. Mohole No. 1

March 3 Drilling 28,497 - basalt
4 " 28,512 - "
5 " 28,712 - "
6 " 28,800 - "
7 " 28,810 - "
8 " 28,912 - "
9 " 28,916 - "
10 Circulated for samples at 28,928.
Sample was 20% fragmental pitchfork tines
40% Tao Dynasty halbert fragments
40% amygdaloidal basalt
11 Prep. to run core barrel
12 " " " "
13 Coring 28,928-36
Recov. 2' vitreous nickel-iron
2' intercalated globigerina ooze and blue ground
2' San Andres dolomite
2' missing core (core barrel melted bottom 2')
14 Prep. to run drill stem test 28,928-36
15 " " " "
16 " " " "
17 Tool open 8 AM: fierce blow immediately, increasing to raging in 20 seconds; mud to surface in 30 seconds, live steam in 1 minute; magma in 2 minutes; estimated 40 barrels per minute of magma, temperature 612° F, density 8.2, spectrographic determination 80% Ni-Fe, 20% brimstone; shut in after 3 minutes. Pulled tool loose and started out of hole. Two stands out, drill pipe unloaded magma. Well began kicking.
18. Blowout preventers closed
19 Blowout preventers leaking steam and magma
20 Blowout preventers failed completely. Magma flowing by heads; steam cloud now 4 miles in diameter over location.
21 Rig now listing 6° NE
22 Boiled fish appearing at surface for 15-mile radius around location
23 Moving in tender to shoot in attempt to bridge hole
24 Steam cloud now 12 miles wide, 2 miles high
25 Prep. to evacuate drill site
26

DEAR PROFESSOR:

Here I am again with more scientific questions. I have read a few times of a bunch of scientific men who propose to drill through the earth's crust to see what it's like down there.

Experience is the best teacher. Possibly they can get a sufficient answer without all that trouble and expense. Just take a look at the Asteroids. Or possibly wait till our boys make a regular stop on some of their special round trip excursions to Jupiter. The inhabitants there can tell them all about the experience. I think.

The best I can make out, all the center of our earth is iron so hot yet can't liquify on account of pressure from above, olivine, granite and sediment.

It seem to me that if even a little hole of one inch relieves that pressure, that the iron would turn liquid in that spot and the pressure would shoot it half way to the moon and continue to liquify on all side till; well we'd go like the Asteroids. And we may not have to go down so very far till the liquifying process starts. I suggest you try some way to put a stop to it. —I mean the drilling.

Yours truly,

EDITOR'S NOTE: This letter was received by a well known professor of geology who felt that it was worth sharing with fellow-geologists.

DEAR EDITOR:

GeoTimes seems to be a good place to call attention to a source of geological information, which is not properly used. Reference is made to temporary exposures. Foundations for various purposes create exposures, which are very soon covered up. Interesting geological features in road cuts may be covered by retaining walls or deteriorate due to weathering or vegetation. Hard rains and floods create new exposures but also cover old ones. In pipeline construction the ditching machine is followed by the crew laying the line and very soon bulldozers cover and fill the ditch. Information on drill holes is often lost. In some states it is mandatory to turn in a log on test for oil or gas. However, these rules are not strictly enforced and the authorities often pay little attention to the accuracy and completeness of these records. Exposures in mines are, of course, temporary. Due to the present depression in the coal business strip pits are filling with water, underground mines are abandoned, maps of the workings are lost, men acquainted with the mines move away or die. Rock quarries and especially gravel pits ought to be under continuous surveillance. A special case are the artificial lakes. Complete geological information on the basin to be flooded may furnish valuable information for the proper location of the dam and for its foundation.

The geological surveys seem to be the proper organizations to collect and preserve this information. While most of them do not have enough personnel for such a project, they ought to be prepared to investigate any temporary exposures, which are reported to them and seem interesting. Geological departments should take a hand at this problem. The students could furnish some manpower to locate and with supervision study the exposures. It would give them a chance to see more outdoor geology than is possible under the ordinary curriculum. An appeal to science teachers and scout leaders should be made to obtain information on important temporary exposures and to report them to competent investigators. Newspaper articles on interesting discoveries would create general interest in temporary exposures and help bring our science before the general public.

Unfortunately local museums suitable as depositories for fossils, specimens, cores, etc., are a long ways apart. So called sample libraries in some of the centers of the oil business help preserve some information, which may be very important and otherwise would be lost.

Sincerely,

ED. BLOESCH

DEAR EDITOR,

According to Mr. L. W. Leroy *(GeoTimes, March 61, p. 37)*, the limited presentation period of papers at national meetings does not do justice to the subject, the speaker, or the audience.

I believe that any subject can be presented in ten minutes. The general problem, the method applied and the results of the work can be laid out with some appeal to everybody. Those in the audience who are particularly interested in the matter can be attracted. Poor speakers will

Statistics for Geologists

NSF Conference at Colo. State U.

A summer conference for college teachers dealing with "Statistics for Geologists" will be held at Colorado State University, Fort Collins, Colorado, July 31 through August 25, 1961.

The Director for the conference is Franklin A. Graybill of the Statistical Laboratory of the University who will be the lecturer on basic statistics. Professor William C. Krumbein of Northwestern University will lecture on application of statistics to geology. There will be daily laboratory-problem-solving sessions. Guest lecturers will include Walter B. Langbein and Felix Chayes.

Thirty college and university earth science professors, and ten earth scientists from industry will be accepted for the Institute. $390 stipends plus travel expense are available for the college and university professors. A fee of $400, which includes room and board for one, will be charged to participants from industry.

For information write *John A. Campbell, Dept. of Geology, Colorado State Univ., Fort Collins.*

GAGARINIT is a new mineral (composition not known) which Soviet geologists hastened to name after cosmonaut Yuri Gagarin.

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never exhaust their subject and will bore any audience to death, no matter how much time is available.

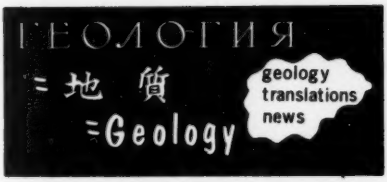
This country has a fine system of organizing national meetings. By too much selection of papers, our meetings might lose their fresh atmosphere. A maximum of qualified speakers may be prevented from finding a maximum of interested listeners, inhibiting an optimium of idea exchange.

I am very much in favor of stiffening admission requirements for speakers at national meetings by severe criticism of abstracts and visual aids, as was attempted previous to the Denver meetings. If need be, presentation time should be shortened to 7½ minutes. He who cares will do justice to any subject, and any audience, in any time.

Mr. Leroy's suggestion that a paper should be ready for publication before it is accepted on a convention agenda is another subject deserving critical discussion.

Sincerely,

BRUNO E. SABELS,
Institute of Geophysics UCLA



During 1959, Section 8 of *Chemical Abstracts* cite more Russian titles than American and British combined. Here is a breakdown of records kept by Mike Fleischer:

	1957	1958	1959
U.S.S.R.	542	816	1112
U.S. & U.K.	796	650	702

This covers only petrography, economic geology, mineralogy and geochemistry, but even so it is most impressive.

Bringing American geologists in contact with this vast volume of literature is the task of AGI's translations program, complemented by those of the American Geophysical Union and the Geochemical Society. It is a slow, painful, step-by-step process. The first awareness by American geologists of an article or book of importance is usually the result of the systematic combing of Russian literature by the staffs of such indexing and abstracting journals as *Geophysical Abstracts, Annotated Bibliography of Economic Geology, Chemical Abstracts,* and the *Bibliography and Index of Geology Exclusive of North America.*

The next step, obtaining a translation, is tougher. Some geologists can have translations made for their particular needs but most are dependent on pre-existing ones. A start has been made toward helping the geologists locate these. The John Crerar Library (86 East Randolph Street, Chicago 1, Ill.) files and sells copies collected from private sources. The Office of Technical Services, U.S. Dept. of Commerce, does the same thing for translated materials of Federal government origin and draws from other sources for listings in *Technical Translations* ($12.00 per year, Superintendent of Documents, Washington 25, D. C.). To serve the specific needs of geologists, AGI's *International Geology Review* lists translations of geologic relevance combed from these and other sources, indicating the title, author, source, and how the translation may be obtained.

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promises another though smaller center for industrial development based on iron and manganese ores, oil and uranium minerals.

North Africa comes in third place. Though less endowed with mineral wealth than the austral and central zones she has promising potentialities enhanced by a better native man power. Her assets would be significantly increased if the states of the Maghreb could agree and develop their resources in common. The district of Colomb Béchar in Southern Algeria, within the range of the Saharan gas fields and with coal, iron, manganese, copper, lead and zinc ores in its vicinity has been called in anticipation a "future African Ruhr." Ambitious economic and industrial projects putting together all North-African potentialities have already been published. Their realization awaits a complete pacification of Algeria and the collaboration of the Maghreb with France. But to launch North African collaboration seems as difficult as it is to promote the European and for the moment each state is developing separately its own industry.

In Western Africa the resources in bauxite and hydro-electric power enable Ghana, Guinea and the Cameroon to develop an aluminum industry scheduled for an important expansion over the next few years. This part of the continent is expected to become a major producer of aluminum before 1970. Will this represent a sufficient step toward industrialization? At the present time industrial power still rests on steel and coal, and except for Nigeria, Western Africa lacks coal deposits. Italy has developed a steel industry based on imported coal and iron ores but it is unlikely that African states might follow such an example for the moment. Thanks to technical improvements it will be possible in the near future to produce steel economically in electrical furnaces with only small quantities of coal. When this happens the profitableness of African iron ore deposits in the vicinity of water power sources will be greatly increased. However, after it has been produced steel must be sold. Only in Nigeria do we meet some of the conditions compatible with the birth and growth of industrial power: coal, iron ores, limestone, water, oil and an abundant population.

The potentialities of Eastern Africa are limited. Among these territories Uganda is farthest on the way to industrialization. This is due to the water power stored in the Nile basin and to the development of the copper deposit of Kilembe. In the long run the possibilities of Tanganyika ap-

Mineral Commodity Seminars

The Geology Department of the Colorado School of Mines, during the present semester, has been holding a lecture seminar series on the geology of certain mineral commodities. The series was built around talks mainly by U. S. Geological Survey mineral commodity specialists from the nearby Denver Federal Center. The guest lecturers have been J. B. Cathcart, Ogden Tweto, W. R. Griffitts, R. P. Fischer, A. P. Butler, J. C. Olson, A. H. Koschmann, D. F. Davidson, D. A. Brobst, A. F. Shride, and T. S. Lovering. John W. Vanderwilt, president of the school, also has been one of the lecturers.

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pear to be good; for the moment industry in that territory is linked mainly to agricultural goods.

The sixth zone to be considered, North-East Africa, is the poorest of the continent. Only in Egypt does some element exist: iron and manganese ores, phosphate rocks, oil, hydro-electric power. The building of a steel works is on the way. However its capacity is expected to remain small and unable to sustain a war industry.

Summary

In summary, in spite of the efforts which have been made, Africa is far from having an industry on the scale of her population and of her mineral resources. For a long time she will remain a producer and an exporter of raw material. Many African states are trying to develop and diversify their economy and to increase their production. A greater rate of progress depends on more capital, more skill and experience and on a rise of the productivity of African man power. The latter may be increased by education and training. In the present state of the world development, instructors for African people and suppliers of technical and managerial skills may be provided in great numbers by white nations only. As far as private capital is concerned western countries only are to be considered. Anyhow Africa depends heavily on foreigners for her development and consequently the question of race relations is a factor influencing investors and prospective white advisers. The restoration of peaceful interracial relations is a fundamental condition for the expansion of the African economy. Moreover, public and private western capitals will be refractory to the idea of investing money in territories opposed to Free World influences. Between subjection to the West and hostile independence, a middle course must be found.

In order to promote an orderly and continuous economic evolution, to avoid as far as possible economic crises and the ensuing political crises, to reduce the risks of political blackmail, it seems wise to search for some kind of multilateral agreements between raw material producer and consumer nations. Prices of minerals should be regulated at the same time as the level of their production. The International Tin Agreement has shown how difficult such negotiations may be, but the experience made in this connection may help to solve many difficulties.

References

Postel, A. W., 1943, *The Mineral Resources of Africa*, 1 vol. 105 p. Philadelphia.

Statistical Tables, published by Metallgesellschaft Aktiengesellschaft.

Minerals Yearbook, published by U.S. Bureau of Mines.

Woodtli, R., 1961, *Les resources minérales de l'Afrique*, 1 vol. Lausanne.

Toronto Mineralogical Club Awards Prize

The Walker Mineralogical Club of Toronto announced the award of the 1960 Peacock Memorial Prize "for the best scientific paper on pure and applied mineralogy, including crystallography, mineralogy, petrology, ore genesis and geochemist" to Dr. Joseph E. Patchett who received his Ph.D. from the University of Toronto in 1960 and is currently employed as a crystallographer in the research department of the Norton Company, Chippawa, Ontario. The title of his prize-winning paper is "*A Study of the Radioactive Minerals of the Uraniferous Conglomerate, Blind River Area.*" Dr. Patchett, a native of Middletown, N. Y., completed his undergraduate work at Rutgers.

The two hundred dollar Peacock Memorial Prize will be awarded again in 1961 and is open to graduate students enrolled in a Canadian University, a Canadian graduate student enrolled in any university or any graduate student writing on a Canadian subject. Papers must be submitted by December 31, 1961. More details can be obtained from *The Secretary, Walker Mineralogical Club, 100 Queen's Park, Toronto 5, Canada.*

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Science In Antarctica—The Physical Sciences In Antarctica, *Part II of a report by the Committee on Polar Research, National Academy of Sciences-National Research Council, Publication 878, 131 pp., 1961, 2101 Constitution Ave., N.W., Washington 25, D. C.*

This volume undertakes an appraisal of present knowledge in the Antarctic for various physical sciences and considers desirable objectives for future research programs.

Reservoir Engineering Manual, *by Frank W. Cole, 1961, 344 pp., Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas, $11.50.*

This is a reference book for engineers (and geologists) dealing with reservoir problems. Describes characteristics of the various types of reservoirs and the predicting of performance under varying conditions.

Elements of Photogrammetry, *by Wilfred H. Baker, 1960, 195 pp., Ronald Press Co., 15 E. 26th St., New York 10, N. Y., $5.00.*

A concise presentation of the fundamental principles and methods of photogrammetry. Excellent for obtaining a working appreciation of aerial photography.

Scandinavian Research Guide, *2 vols: 1960, published by the Scandinavian Council for Applied Research, Gaustalleen, Blindern, Norway, $10.00.*

A reference work for persons engaged in science and technology, giving concise, detailed and factual information on 1500 research institutions in the Scandinavian countries.

Industrial Research Laboratories of the United States, *1961, 698 pp., National Academy of Sciences-National Research Council, Publications Office, 2101 Constitution Ave., N.W., Washington 25, D. C., $12.00.*

Gives name, address, principal officer, research staff (numbers of various kinds), and types of research conducted.

The Water in the Soil, *by A. A. Rode, 464 pp., 1959, Akademie-Verlag, Berlin, D.M. 56.*

An abbreviated and revised German translation of the 1952 Russian edition. Discusses systematically the nature, function, role, and classification of the water in the soil, including its influence on and relationship with weathering bed rock. Offers a new classification of the water in the soil. G.C.A.

THE PRECAMBRIAN GEOLOGY AND GEOCHRONOLOGY OF MINNESOTA, *by S. S. Goldich and others, 1961, 193 pp., University of Minnesota Press, Minneapolis, $4.00.*

An important report contributing significantly to the understanding of the Precambrian of the Lake Superior area particularly through its data on potassium-argon and rubidium-strontium radio-active dating of igneous and metamorphic rocks.

AERIAL PHOTOGRAPHS IN GEOLOGIC INTERPRETATION AND MAPPING, *by Richard G. Ray, 230 pp., 1960, USGS Prof. Paper 373, U. S. Gov't Printing Office, $2.00.*

This publication is an excellent text and reference on the use of aerial photographs as applied to geologic field studies. Contains 73 stereo pairs to illustrate various geologic features. This publication, because of the wealth of data it contains, the stereo pairs and its low cost, will be widely adopted for classroom use in training geology majors.

The Georgia Geological Society was recently founded by a group of 50 charter member earth scientists representing industry, federal and state geological surveys, and educational institutions. The purpose is to advance the science of geology and to aid in the development of the mineral potential of the state. Information on the new society may be obtained by writing *Prof. Chester R. Smith, Chairman, Georgia Geological Society, c/o Dept. of Geography-Geology, Georgia State College, Atlanta, Georgia.*

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GSA *(Continued from page 23)*

for the grade of Member are: (1) A Bachelor's degree with a major in geology or a related science, or equivalent training through practical experience, and (2) Active connection with geology through employment in geological work, or in teaching geology, or through status as a graduate student in geology. The candidate must be sponsored by *two* Fellows of the Society who are personally acquainted with him (her) and his (her) qualifications.

The Bylaws of the Society state that "Fellows shall be persons who are engaged in geological work or in teaching geology and who have contributed to the advancement of the science of geology." The rules of the Society's Council stipulate that "in principle, election to Fellowship shall be restricted to residents of the Americas, but in special cases may be extended to those non-Americans who have published results of their geological research conducted in the Americas and who show evidence that their interest in the geology of the Americas will continue." A candidate must have been a Member for at least one year before becoming eligible for nomination to Fellowship. He shall have had five years' professional experience in geology or related fields; graduate work may be substituted for a maximum of three of the five years. The qualifications of the candidates are classified in four categories: (1) Research, (2) Administrative work, (3) Training of geologists, and (4) Other activities. A candidate is not required or expected to qualify in each of the categories, but if his accomplishments are limited to one of the last three categories, they should be particularly outstanding. Fellowship candidates must have *three* sponsors who are Fellows.

Fellows and Members pay $15 per year as dues, with the exception that Members with a Bachelor's degree dated less than five years ago pay $12 per year. Each Member and Fellow receives a subscription to the monthly Bulletin without extra charge. He is also entitled to purchase a copy of all other publications of the Society at a discount from the price to nonmembers and institutions. Only Fellows are entitled to vote and are eligible for election as Officers or Councilors.

The two classes of membership provide for an orderly progression from the class of Member to the status of Fellowship within the framework of specified terms of eligibility and qualifications. It is believed that a practicing geologist actively concerned with the advance of the science

can be expected to make contributions that will qualify him for Fellowship.

In the past, the initiative for nominating candidates for Fellowship has rested with the Fellows, who must assume sponsorship. It has been recognized that the standards for Fellowship will not be compromised by permitting and encouraging Members to take the initiative in their own behalf. Thus, the Member who is interested in promotion to Fellowship can initiate the action by obtaining the forms and seeking his sponsors. The responsibility of the sponsors remains unchanged; acceptance of a request by a Member to become one of his sponsors should be primary evidence that the Fellow considers the Member to be a suitable candidate. His evaluation, submitted to the Society, should be convincing support of this tacit approval of the candidate.

The Society hopes that this message will encourage all of those who have meant to seek Membership to do so and those who are Members to seek Fellowship. The Geological Society of America is the one organization that brings together, as individual members of one society, scientists from *all* fields and phases of geology and related sciences throughout all America.

Oceanographic Opportunities

Expansion in the Coast and Geodetic Survey oceanographic program is creating a growing need for more oceanographers and geophysicists (*GeoTimes, March 1961*). A limiting factor in the continuing expansion is qualified personnel for research and development as well as for processing, analysis, interpretation and publication of oceanographic and geophysical data. Although the need is for physical oceanographers and geophysicists at all grade levels a few geological or biological oceanographers will also be required.

A college graduate qualifies for the entrance grade of GS-5 physical oceanographer with a bachelor's degree which included 48 semester hours of courses in any combination of physics and engineering sciences, chemistry, physical oceanography, meteorology, geophysics and mathematics, including 3 hours of calculus and 6 hours of physics or physical oceanography.

To qualify for geophysicist, the bachelor's degree must have included at least 24 hours of geophysics, physics and mathematics with differential and integral calculus and 6 hours of physical science.

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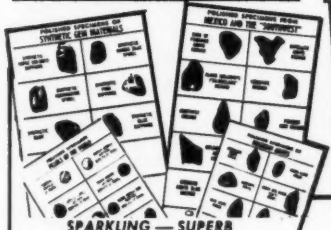

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MINERALOGIST. Ph.D. required. Major in mineralogy; experience with X-ray and spectrograph. Assistant Professorship for September, 1961. Submit credentials, including academic record. Department of Geology, Colorado School of Mines, Golden, Colorado.

PALEONTOLOGIST: Ph.D. or equivalent experience to do research using microfossils for detailed environment interpretation. A background in statistical application preferred. Reply to: Director, Exploration Research Division, Continental Oil Company, Ponca City, Oklahoma.

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BOX 768. GEOLOGIST-MINERALOGIST, Ph.D., 31, family. Three years experience in major oil company research laboratory in fields of X-ray and fluorescence analysis, clay mineralogy and geochemistry of sediments. Broad graduate background in geology. Desires position at college or university. Available immediately.

BOX 774. GROUND WATER GEOLOGIST-HYDROLOGIST, 40, family. 1 year post graduate work. Five years experience with USGS, five years consulting. Geohydrology and engineering background with experience throughout U. S. Interested in position of responsibility. Open to foreign work. Resume on request.

BOX 786. GEOLOGIST, nine years experience in the Four Corners, Panhandle and West Texas. Broad exploratory background includes sub-surface, administration and seismograph. Some field and well work. Desires more responsibility.

BOX 787. GEOLOGIST, Ph.D. Desires teaching and research position in University in SEDIMENTARY PETROLOGY, STRATIGRAPHY (Principles), and SEDIMENTATION. Can also teach Regional Stratigraphy, Regional Geology, Historical Geology, Invertebrate Paleontology, Hand-specimen Petrology, Structural Geology, Geomorphology or Pleistocene Geology. Special interests include sedimentary rock petrogenesis, sedimentary structures and paleo-currents. Previous teaching experience at elementary and senior level. Field experience in North America and Europe. Location preferred: Northeast US, North-central US, Northern Rocky Mountains, Pacific Northwest and Canada. Currently employed.

BOX 789. GEOLOGIST, Ph.D. (1952) desires teaching position; morphological and optical crystallography, mineralogy, petrology, petrography and/or structural, regional, and historical geology. Over ten years teaching experience, mainly in large institutions; small or medium-sized college preferred.

BOX 796. ASST. PROF. Ph.D. Isolated State University wishes to teach in college or university in more desirable locale. Active researcher, Member professional societies, Bilingual, 5 yrs. varied governmental and industrial experience, 4 years teaching experience. Resume on request.

BOX 799. GEOPHYSICIST, 15 years experience exploration geophysics in U. S., Venezuela, Brazil and Libya. Broad background seismic techniques, experimental and production field operations, interpretation and evaluation of results in terms of geological objectives. Presently senior staff geophysicist, excellent references. Desires responsible position domestic or foreign.

ENGINEERING GEOLOGIST, B.A.—Geol., M.S.—Eng. Geol., Age 32, married, 8 yr. exp. in water, geophysics and soils; J. Edwin Garrison, 434 William Dr., Brownsburg, Indiana.

BOX 817. GEOLOGIST-PALEONTOLOGIST. B.S., 32, family. 8 yrs. experience in the West Texas, Texas Panhandle, and Four Corners Areas. Background includes subsurface geology, micro-paleontology and administration. Desires responsible position, domestic or foreign. Alert and willing to work to obtain such a position. Resume sent upon request.

BOX 819. GEOLOGY ENROLLMENT HAS BECOME MICROSCOPIC. Therefore, Geology Professor seeks other employment. Biostratigrapher, Ph.D., 35, family. Four years petroleum exploration and 4 years teaching experience. Will consider other teaching or industry position. Excellent references. Available this summer.

BOX 820. GEOLOGIST—B.S., M.S. June '61. Married, veteran, 26. Thesis: Petrology of S.S. Road Aggregate. Knowledge of X-Ray diffraction procedures. Interested in Ig. and Meta. Petrology. Recipient of State Roads Fellowship. Good references.

BOX 822. GEOLOGIST, 30, B.S., M.S. in geology with a minor in chemistry. Experience in petrology dealing with composition and petrofabric analysis. Two years experience in hard-rock geology. Will do domestic or foreign work. Resume of experience, academic qualifications and references on request.

BOX 823. MICROPALEONTOLOGIST-GEOLOGIST, 29, M.A., Ph.D., Sept. 1961, desires academic position in university or college with opportunity for research. Principal interests: paleontology, paleoecology, stratigraphy, submarine geology, petroleum geology. Two years experience with major oil co. Publications.

BOX 824. HIGHWAY ENGINEERING GEOLOGIST, B.S., graduate school, 35, married, no children, 13 years experience with Federal & State governments in geophysics, foundation exploration, materials surveys—presently em-

POSITIONS WANTED—Continued

ployed as Material Engineer with supervisory duties over compaction testing, aggregate production, concrete and asphalt control. Would like foreign or domestic work. Consider teaching assignment. Resume on request.

BOX 825. DISPLACED MINERALOGIST-PETROGRAPHER, 31, M.S., desires immediate geological employment, foreign or domestic. Speak Spanish, single, will consider teaching.

BOX 826. INVERTEBRATE PALEONTOLOGIST, recent M.A. (Late Paleozoic) Univ. Calif., seeks summer job museum, field, research ass't, etc. Field experience. Free to travel. Available June 15 through Sept. 15.

BOX 827. GROUND WATER ENGINEER. 42, small family. Experience includes all phases ground water exploration and development in Saudi Arabia, Jordan, Spain, East Africa, Turkey and Iran. Experienced in dealing with foreign governments at all levels. Desires responsible supervisory position. Now employed, available about August. Resume on request.

BOX 828. PETROLEUM GEOLOGIST, M.A., 10 years experience all phases oil and gas exploration with major companies and consulting in Rocky Mountain area and Williston Basin. Lease and farmout experience. Administrative ability, family, veteran. Desire responsible position with small aggressive group, will travel. Excellent references. Resume on request.

BOX 829. GEOCHEMIST, 29, family, Ph.D. expected '61. Ten yrs. geological field experience, seven supervising exploration geochemistry. Masters and doctorate thesis on low temperature reactions of sulphides. Considerable lecturing and demonstrating experience. Excellent references on teaching and field abilities. Desires teaching and/or research appointment commencing autumn; would consider industry position of semi-research nature.

BOX 831. CRYSTALLOGRAPHER-MINERALOGIST, 30, Ph.D. in soil science, Ph.D. in geology expected, summer 1961. Experience in clay mineralogy, single crystal x-ray structure determination. Desires teaching and/or research position. Resume of qualifications, publications upon request.

BOX 832. WOMAN GEOLOGIST seeks office geology or library research. 14 years experience in U.S., Newfoundland and Africa includes bush prospecting, report writing and general assistance at corporation head offices. Free to travel.

BOX 833. MINING GEOLOGIST-BSc. geol. one year graduate work; nine years varied exploration and mining experience with large American companies. Seeks position in same type of business, U.S. or foreign. References; resumé on request.

BOX 834. EXPLORATION GEOLOGIST, 35, highly varied experience in all phases of mapping, property evaluation, drill exploration, etc. 7 yrs. foreign experience in Africa, Guatemala, Mexico. Accustomed and delight in difficult assignments under adverse conditions. Speak Spanish. Seeking foreign position. Resumé on request.

BOX 835. GEOLOGIST, Ph.D. summer 1961, 30, family. Background (western U.S.) includes four-years mineral exploration and evaluation (metals, non-metals), two years stratigraphic research. Outstanding industrial references and academic record. Interested in economic applications of geology including petroleum. Opportunity of prime concern, salary secondary. Resumé.

BOX 836. GEOLOGIST, 29, Ph.D. expected 1961. Ore deposits, igneous petrology and geochemistry are main interests. Desires research position in either industrial or academic environment. Resumé on request.

BOX 837. ECONOMIC GEOLOGIST and MINERALOGIST—Ph.D. Almost 20 yrs. experience teaching and with the U.S. Geological Survey. Presently employed at a prominent Midwestern University. Interested in moving because of family and personal reasons. Would prefer location in the southwest either with a university or in industry.

BOX 838. GEOLOGIST, Ph.D. June 1961, M.A. in Geology, M.A. in Geography, 5 yrs. teaching experience as Ass't Prof. of Geology, Field experience with A.E.C., desires teaching position. Avail. Sept.

BOX 839. GEOLOGIST, Ph.D. with broad teaching background desires teaching position or museum work. Principal fields taught: structural geology, petrology, mineralogy, geomorphology, paleontology, economic geology. Can teach other geological fields and biology.

BOX 840. GEOPHYSICIST, Ph.D. Geophysics, M.S. Physics. Ten years experience with major oil company, including five years foreign. Experience in applied geophysical research, supervision of geophysical exploration programs, geophysical interpretations, and the interpretation of geophysical and geological data. Desires challenging supervisory or applied research position, domestic or foreign.

BOX 841. ECONOMIC GEOLOGIST, Ph.D., P. Eng., age 43, 12 yrs. experience with major companies in exploration, evaluation, mine development and geophysics. Linguist. Available now, domestic or foreign work or teaching.

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CONSULTANTS

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A. McGUGAN, GEOLOGIST-STRATIGRAPHER specializing in paleontology and micropaleontology, P. O. Box 672, Calgary Alta., Canada.

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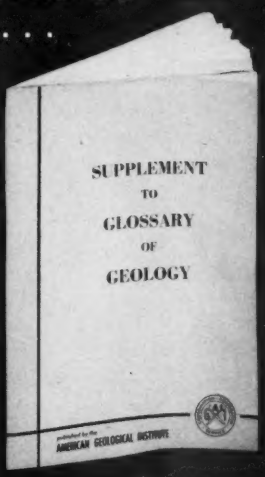

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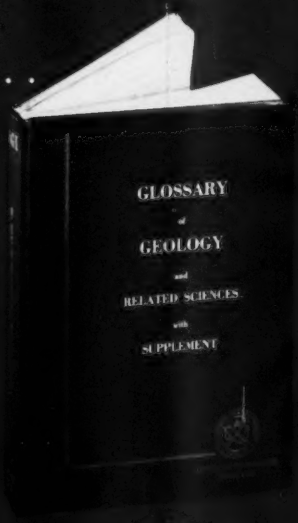

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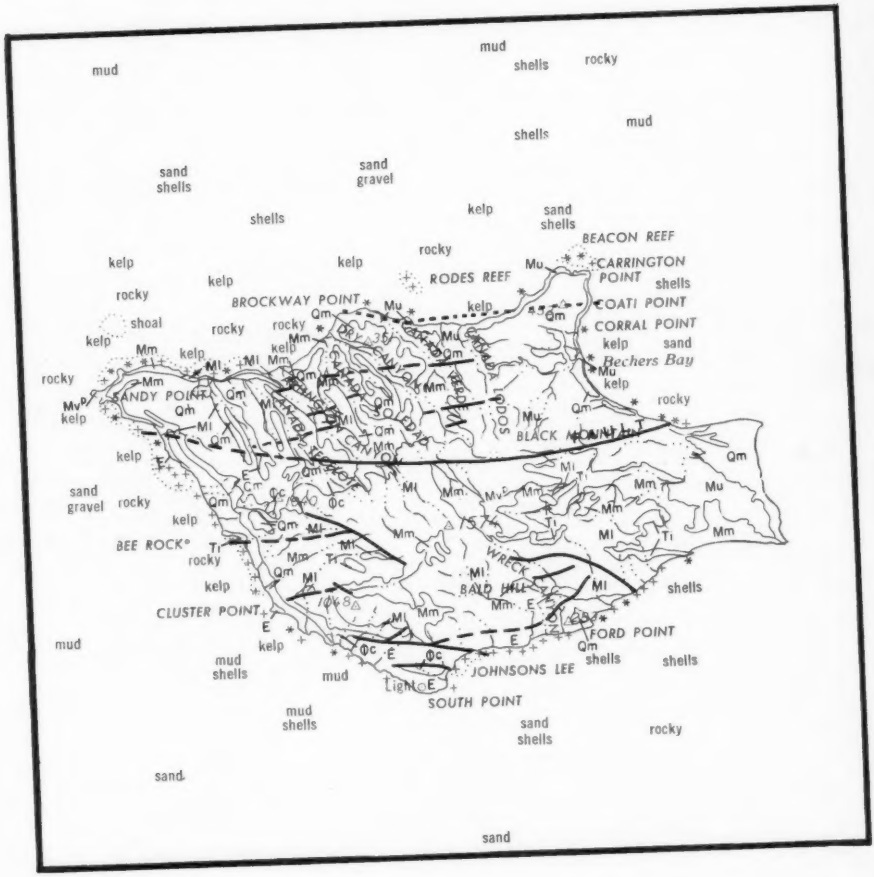

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Look on page 52.

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